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Vol. VI. NEW YORK, OCTOBER 3, 1885. No. 14

THE correspondence of our New England and Western representatives gives a pleasing picture of growth in the electric lighting business. The industry has not waited for better times, but will now improve with them.

A WRITER in one of our esteemed contemporaries says that since the introduction of the electric light the consumption of gas in every town where both systems are used has increased nearly five per centum. This seeming inconsistency is explained by the fact that the almost mid-day brilliancy of the electric light has made people dissatisfied with their dim gas-light at home, and they now use two or three jets where in former times they used only one.

IT has been generally believed that the People's Telephone Company had "had its day and ceased to be," but now, just when the public mind is agitated over the question of the validity of the Bell patent, it "bobs up serenely from below," and announces that through its senior counsel, Senator Edmunds, of Vermont, it will make a motion before Judge Wallace, in the United States Circuit Court, for a new trial, on the ground of newly discovered evidence, consisting in the statements of several witnesses that they saw or heard the Drawbaugh telephones, or heard them described by many others, previous to 1874. The motion will be made early in October, and should it not be granted, an appeal will be taken to the United States Supreme Court. Things begin to look lively in the telephone field.

THE resistance which the human body offers to the passage of a current continues to be a subject of discussion, notwithstanding the numerous experiments which have already been made. We give in this issue the latest results of Dr. Stone, who has devoted considerable time to the study of this question, and who ranks as an authority on it. According to him, the resistance is far less than has heretofore been assumed. The discrepancies, as pointed out, are largely due to the imperfect contacts between the body and the electrodes employed in former experiments. The results prove once more that in view of the great susceptibility of the body to electric currents Nature has wisely provided us with a high insulating protection in the shape of the skin.

WHEN each week's Patent Office gazette brings a dozen new mechanical car-couplers to notice, it is refreshing to know that electricity has been called in to aid in solving the problem. Thus a South Carolina genius claims to have invented a perfect system of car-coupling by electricity. Upon a recent trial a freight train was cut in four pieces and again coupled up without the aid of any person except the conductor, who did the entire work from the rear car. If the applications of electricity to railway working continue to multiply as they have of late, we may expect, in the near future, to see every road establishing a department of electrical engineering, similar to the mechanical and civil now in vogue.

IN the wake of the recent South Foreland experiments regarding the efficiency of various illuminants for lighthouse purposes, comes the announcement that the incandescent lamp is to be applied here for the same purpose, on account of its increased power for penetrating fogs. While the latter fact is undisputed, the question of economy must not be lost sight of, for it is well known that the light per horse-power produced respectively in the arc and incandescent lamp is in the ratio of about 8 to 1. Thus while in fair weather the penetration per horse-power would be far greater for the arc than for the incandescent lamp, this increased brilliancy would also make it more efficient, or at least equally so in foggy weather. If economy be not considered, however, there can be no doubt that with equal brilliancy the incandescent lamp is preferable for various reasons in addition to the one given above. The subject is an interesting one and we hope Major Heap will continue to labor at it.

Now that the electric light has obtained a firm hold as a street illuminant, care should be taken that its reputation does not suffer. This admonition is timely in view of the complaint made in a large city of this State that the city lights do not burn as brightly nor as steadily as those furnished to private consumers. This fault is evidently not one inherent in the system, but is without doubt due to the fact that more lamps are put upon the circuits than the machines were designed to operate. The city named is not the only place afflicted with this evil, and the sooner this practice is stopped the better. If not, the gas companies will have an excellent argument to bring forward against the dim and uncertain electric light. The public having once become acquainted with a good arc light can now readily detect those of poor quality, as the incident shows, so that electric light companies would do well to put in an extra machine rather than lose the good will of the people upon whose votes they largely depend for their contracts.

IN denying the injunction asked for by the Western Union Telegraph Company, Judge Wallace, for the time being, leaves the Baltimore & Ohio Company in peaceful enjoyment of the Stearns duplex. To those who have followed up the case it must have been evident from the beginning that no other conclusion could very well be arrived at. Setting aside the pleas of non-originality, made by the Baltimore & Ohio Company, it is clear that in the light of the recent decision of the U. S. Supreme Court, the reissued patents are of doubtful validity. While it is true that the latter were taken out before the promulgation of that decision, the late day at which this was done and their changed character have weakened them to such an extent that their successful tenure may well be open to doubt. What the final decision in the case may be is well foreshadowed in Judge Wallace's remarks, in which he says that the reissue "is upon its face a flagrant attempt to enlarge the scope of the invention in order that the patent might be more available in the suppression of all competing inventions." In this connection it may be well to point out that a patent is reissued only when a mistake caused by inadvertence, accident or fraud can be proved in the original patent. The claims, according to Supreme Court decision, cannot be broadened or made to include anything not originally claimed. This decision, however, has not been upheld in all cases.

IN this age of delicate tests too much care cannot be taken to eliminate the errors due to accidental disturbances, which, if undetected, may make the results valueless. As an instance, we may cite the experience of Mr. John Munro, who, in making some determinations with a high-resistance Thomson voltmeter, found a continual disturbance of the needle upon his approach to the instrument. An investigation revealed the fact that a steel wire in the brim of his hat was the cause. Upon the heels of this experience comes that of an experimenter whose work was disturbed by a static charge of electricity. In this instance a delicate balance was found to be acting in an erratic manner. In these instruments, as is well known, the beam is provided with a "milligram rider," which is manipulated from without by a rod passing through the glass case. The electricity generated by the friction of this rod distributed itself over the glass case, and was sufficient to throw the balance out of equilibrium to a considerable extent. The approach of the flame of a Bunsen burner immediately dissipated the charge. The experimenter, however, proposes to remedy the evil by surrounding the lower end of the glass by a wire network connected to earth. May not some of the extraordinary results obtained by some assayers of newly-discovered minerals be traced to this source?

To any one observant of the changes which have taken place in recent years, none are more important, from a theoretical and practical standpoint, than those which have occurred in the physical standards. New and better-defined units have been introduced into the science of electricity, and the final determinations have as yet by no means been reached. It would seem, however, that it is not the units alone which need revision. Our existing electrical tables contain errors of experiment, which close study, by the most approved method, and with delicate apparatus, now reveals. In illustration of this we cite the table of conductivity of metals and their alloys lately redetermined by M. Lazare Weiler, and reproduced in another column of this issue. It will be seen that, contrary to the tables heretofore in existence, copper ranks equal to silver in conductivity, and, as a rule, the values throughout are somewhat higher than those given by Matthiessen. The reason for this must be sought in the fact that present methods permit of obtaining the metals in a much purer state, and in greater quantities than was formerly possible. Comparing the table given with others in existence, and furnished in books published within a year or two, we find a most extraordinary difference. Thus one book puts the conductivity of copper (soft) at 94.17, silver being taken as 100. Another gives Matthiessen's table, in which the value appears as 99.95. Finally a pocket-book for electricians states the value at 80. Here is an astonishing variety, which is all the more embarrassing on account of the recognized authority of the books quoted. If M. Weiler's results can be relied on, and there appears to be no reason to the contrary, it proves once more that many old established values need revision. M. Weiler deserves credit for having undertaken this work with such care.

THERE would be something remarkable in the number, variety and persistence of the blows aimed at the life of the Bell patent were it not that the value of the prize at stake is so enormous as to account for litigation even more prolonged and costly than has already been gone through either to break or to defend it. In the latest suit against the patent, that brought by the United States on the petition of the National Improved Telephone Company, there are some unusual features. The article appearing to-day in another column enters very fully into a statement of the manner in which it is sought to prove the direct personal interest of Mr. Garland, the Attorney-General, in the suit, he being a large stockholder in the Pan Electric Company. The defense is made, first, that Mr. Garland's private interests have nothing to do with his public duty; next, that in this case there is nothing on the record to show that Mr. Garland ever heard of the suit, permission to bring it having been granted by the acting Attorney-General, Mr. Goode; and, again, that Mr. Garland has no stock in the National Improved Company. Mr. Garland's action may be perfectly right and proper, but it requires, we think, additional explanation, and we await it with interest. Mr. Garland's absence from his office is no excuse for unusual things done in the interval, and it is safe to assume that Mr. Goode would not have moved without being assured in some way of his chief's approval. It has, of course, to be shown that Mr. Garland acquired his telephone stock since he came into office, but it has also to be shown that that stock in an opposition company would not be benefited by the breaking of the Bell patent by any party whatsoever. It is said that in cases of this kind the practice of the Attorney-General is to consult the Commissioner of Patents before bringing suit, and that no application of the kind was made to the Commissioner on this occasion. It is also said that there have only been four or five suits of this character brought by the government since its foundation, and that in only one—that against Gurney—was the patent set aside, there being no defense. Evidently the suit bristles with points of interest, legal, political and other, and it will be very closely watched by the public, which is, as a whole, not over-ardent in its sympathies with the American Bell Telephone Company, but which has, after all, no desire to see any injury done to honest patentees or the admirable system of patent law instituted in their behalf.

The Forerunners of the Perfected Incandescent Lamp.

BY F. B. BROCK.

The list of patentees in the incandescent lighting field commences with the names of Sawyer and Man, and continues down the list in the order of the issuance of their patents with the names of Jenkins, Farmer, Edison, Hall, etc. Prior to any one of these patentees, however, there stands a trio of inventors who prepared the way for the completed system which followed. Their names in the chronological order of their inventions, are Gardiner and Blossom, Kosloff, and Woodward. All of these men stood upon the very brink of one of the most promising inventions of the world, and one which has a great future before it. The difference between success and failure is often the merest trifle, and a more apropos illustration of the saying was never more signally brought to view.

The invention of Gardiner and Blossom received the Patent Office seal as early as 1858. Their invention possessed all the essential features of the incandescent lamp with the exception that no means were provided to render the inclosing glass case air-tight. Of course this was an important omission.

An illustration of the Gardiner and Blossom lamp is given in Fig. 1. It is truly an incandescent lamp, although the permanency of its light-giving material is severely handicapped by its being exposed to the air while in a state of incandescence.

The luminous material is a spirally-wound platinum coil, which is bent into the form of a simple loop. Plain connections bring it into the circuit. The shape of the inclosing transparency is like that of a watch with flat sides.

The inventors designed the invention more particularly for a signal lamp aboard ship. For this purpose the bull's-eye of the glass on either side is colorless, while the remaining portions were colored for signaling. The light itself was said to be quite brilliant, and could be seen at a great distance through the unshaded central portion of the lamp.

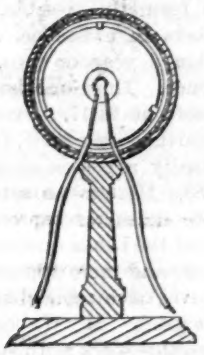


FIG. 1.—GARDINER & BLOSSOM LAMP.

Both the inventors, S. Gardiner, Jr., and Levi Blossom, resided at the time in New York city.

The claim of this patent was as follows (omitting the reference letters), and was broad enough to have covered up the incandescent system of electric lighting, despite the absence of a vacuum :

"The combination of a platinum coil, or its effective equivalent, which is illuminated by electricity, with a transparent signal lantern, said combination being effected by arranging the coil within the lantern upon two conducting wires, which are connected with an electro-galvanic battery."

The patent expired, however, several years before the incandescent system attained a commercial value.

The next one of these three inventions struck even nearer to the mark.

Stephane Alexandrovitch Kosloff, undoubtedly a Russian, but hailing from Paris, lodged in the Patent Office at Washington, and had issued to him as late as 1875, a patent for a lamp, of which we are enabled to give our readers an illustration.

While Gardiner and Blossom used a platinum luminant, Kosloff, as far as the American records are concerned, was the first to use carbon in the incandescent system.

The current of the Kosloff device, Fig. 2, passes through a series of carbon sticks, vertically arranged, the whole of which is placed in circuit, and hermetically closed in a globe filled with a rarefied gas. Each carbon is placed between insulated supports, and arranged so as to allow of a slight movement of the carbons in the supports. Metal is introduced in the carbon ends in order to secure a better contact when the carbon becomes heated.

In the preparation and introduction of nitrogen gas into the lamp after the air has been drawn, the air is rarefied by means of the heated carbon luminant. Upon the expansion of the air, it is caused to escape out of the globe through a cup valve surrounding the supporting column upon which the globe rests, and is prevented from again entering the globe. The small quantity of oxygen remaining in the rarefied air in the globe is said to be transmuted into oxide of carbon.

The drawing shows a number of sticks of carbon arranged for incandescent lighting by the automatic passage of the current from one to another. Kosloff speaks also of the use of a commutator, so that a separate connection may be had for each carbon-stick composing a lamp.

A still closer approach to the inventions of Sawyer & Man and Edison exists in a patent of Henry Woodward, a Canadian, and which bears a date two years earlier than Sawyer & Man's patent.

We reproduce one of Woodward's drawings in Fig. 3. He proposed, moreover, in addition to his lamp, the use of a steam-driven dynamo for generating the current. The carbon, instead of taking the form of a filament, is a dense mass, which, of course, impaired its high efficiency. It is inclosed in a globe, one of the conductors passing out at the top and the other at the bottom thereof.

After the globe has been hermetically sealed at the ends, the air is exhausted, and, if Woodward had called a halt right here, he would have had the great invention within his grasp. But immediately upon the exhaustion of the air, and the closing of the cock, he proceeded to fill the globe with a rarefied gas. This gas was such as would not chemically unite with the carbon when the latter was incandescent. Woodward also states that this rarefied gas becomes in like manner luminous.

The illustration gives a sectional elevation showing a round globe with the prepared carbon located therein. The latter is suspended by the electrodes which enter at the top and bottom. A tube having an air-tight stop-cock for exhausting the air and injecting the rarefied gas, is shown attached to the globe.

The Resistance of the Human Body.

In a paper read at the Aberdeen meeting of the British Association, Dr. Stone brought out the following facts relating to the resistance offered by the human body :

At the Southport meeting of the British Association I

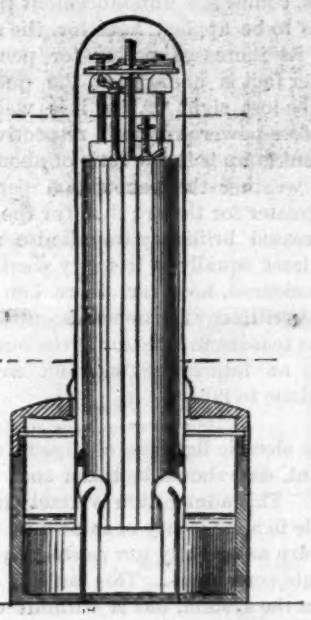


FIG. 2.—KOSLOFF LAMP.

gave a short account of some observations tending to show that the resistance of the living human body to electrical currents was considerably—indeed, surprisingly—less than that usually given in works on medical electricity and physiology. Even such authorities as Rosenthal, in Germany, and Dolbear, in America, assigned values varying from 10 to 100 times the real figure. I produced evidence to prove that this was in the main due to imperfect contact between the body itself and the poles of the measuring instrument. By immersing the patient's extremities in saline solutions, and using large leaden electrodes, this initial error was eliminated, and a fair approximation to the real determination laid before the meeting.

But two secondary difficulties at once presented themselves; first, that the human body possesses considerable electrostatic capacity, and acts as a condenser; second, that it acts as a secondary battery, and sets up a very appreciable counter-electromotive force.

In my Southport paper I described a method of alternating momentary contacts with a reversing key, by which the second of these difficulties was minimized. But even on this plan the later readings were always somewhat higher than the earlier, and the resistance seemed to rise slowly to a maximum. This was clearly counter-electromotive force due to polarization, and the resistance actually noted was the real resistance plus an indeterminable polarization quantity.

So far at Southport. It was, however, then suggested to me to use the alternating current of an induction coil, and to replace the galvanometer by a telephone. At this latter method, which is extremely elegant, I worked steadily for the following year, and as I incidentally discovered that the alternating current of the induction coil introduced to physiological research mainly by Du Bois Raymond had not been measured, I set myself this task, first by means of Kohlrausch's dynamometer, and, secondly, by a modification of Sir W. Thomson's quadrant electrometer. But from the first the results by this method were so singularly discrepant from those I had obtained by the other that I suspected its accuracy.

For instance, in a very tall and athletic man, a student at St. Thomas' Hospital, the resistance from foot to foot was always about 1,000 ohms, but by this method never above 600 ohms. By Mance's method it comes out by two separate observations to be 1007.6 and 1009 ohms; a good result.

It became evident that there were two opposite causes of error, a condenser ation spuriously lowering the reading specially strong with alternating currents and a polarization fallaciously raising it very marked with continuous currents.

To ascertain the exact amount and proportion of either of these presented a task of no small difficulty, and one, indeed, at which I am still working. I hope fairly to complete it in time for the Lumleian lectures, which the Royal College of Physicians have requested me to deliver in the early part of next year.

It struck me that the human body, besides being an imperfect conductor, resembles a very leaky condenser—in fact, it has three attributes, it is a conductor, a condenser and an electrolyte, and is not dissimilar to a faulty submarine cable.

On these points I consulted Mr. Latimer Clark, who referred me to a paper by Mr. Henry Mance, read before the Society of Telegraph-Engineers on May 8, 1884.

By the kindness of Messrs. Clark, Muirhead & Co., I have been able to procure one of Mance's beautiful instruments for exhibition at this meeting.

Mr. Mance very kindly assisted me with his advice, and corrected some of my early results, one of which is on the blackboard.

R_1 945-6	R_2 950-950	result 939	Foot to foot.
R_1 920-933	R_2 1040-1066	result 905.45	Foot to hand.

Now, if the resistance can thus be correctly obtained, the subsequent work is much facilitated. I have already a few rough results, and am steadily increasing their number.

Afraid of Lightning.

The victims of hay fever are not more in numbers or more to be pitied than those who suffer from nervous dread of lightning. Probably more people than usual

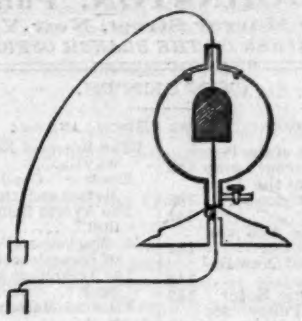


FIG. 3.—WOODWARD LAMP.

have learned to sympathize with this terror during the August thunder storms which have made such panic at summer hotels. Only persons of very strong nerves can go through a hard electric storm without uneasiness. But there is a class whom electricity affects with such peculiar force that, as one of them said, each storm is like being led out for execution, uncertain whether one is to be shot this time or the next. "As one who knows this species of bliss pretty thoroughly for over twenty years," says a writer in the Philadelphia *Bulletin*, "permit me to offer the deepest sympathy to such unfortunates and mention such alleviations as a lifetime of acute misery on this account has found for itself.

"The dread is neither fanciful nor curable by any effort of will. Usually it comes from a violent shock early in life, and lightning does not more clearly print the image of veins and branches on the skin in some cases than it leaves its impression upon the entire nervous system in others. Hours before the storm comes on, the electric changes in the air are felt by the person, either in nervous excitability and restlessness, like that of birds and animals before a storm, or intense depression and sense of impending doom. No Tartarus has curtains of more awful gloom or such shapes of unformed dread as inhabit these hours of oppression. I do not doubt that many of the apparently causeless suicides we hear of are committed under the influence of such distressing moods. They are beyond all visitations of the mind most agonizing and unbearable till one learns to recognize them as purely physical, the effects of ill digestion, of overwork or bodily weakness or the subtle electric changes which bring them on with especial trouble. In some cases while yet the sky is brilliant and not a threatening cloud shows sign, the effect of a coming storm is felt in drastic purging, or the eyesight is affected, while neuralgic persons have a double portion of suffering meted out to them. As the barometer sinks with the coming storm the vitality sinks with it, breathing is hard, and the heart alternately beats so low it can hardly be detected, or with a sharp contraction that seems the precursor of the pang of death. The danger may be entirely fancied, but the distress is beyond description real. I have known the first flash of lightning in a summer storm to send a strong person into an attack like cholera in three minutes, and strike one buoyant and blooming a moment before, colorless, shrunken and unable to stand."

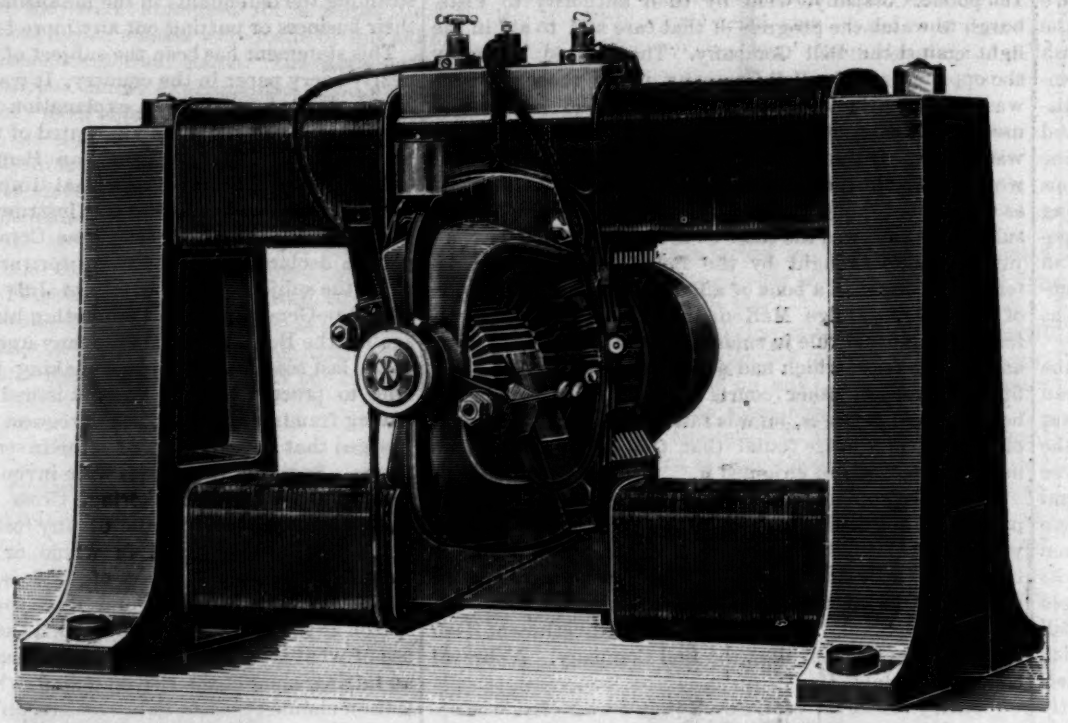
As a remedy the writer suggests a trip to a climate where lightning is unknown, such as California or Peru.

Electric Light at the London Inventions.

Among the electrical apparatus exhibited at the "Inventories" was that of Messrs. Paterson & Cooper. Several of their dynamos were in operation, one furnishing the current for 1,000 16 candle-power lamps. The armature of these machines is of the simple Gramme type, the wire being wound on a cylinder composed of a series of insulated discs. When wound for heavy currents, the wires in the coils are made of small wires stranded together. This method renders the manufacture and repair of the coils easy. There are 84 coils on the armature, and the commutator sections are three inches deep, so as to permit of long wear.

The exhibit also embraced several forms of arc lamps and measuring instruments. Among the former the "Phœnix" lamps were shown. In these the feed is effected by means of a clutch, which holds the top or positive carbon rod. This clutch is made to alternately grip and release the rod by a small hammer, which delivers continually a series of blows upon its free side. The hammer is vibrated by a shunt magnet differentially wound with wire in the main circuit. Fig. 3 shows a very convenient and portable form of instrument manufactured by this firm, in which an ammeter and voltmeter are contained in one case, the two forming a complete set for ascertaining the energy expended in the circuit.

The Cardew voltmeter was also exhibited, and, although not absolutely new, deserves a description. The instrument (Fig. 2) is one specially suited for permanent installations, as it can be left continuously in circuit, and form an indicator which can be constantly referred to by the attendant. This is of particular advantage in electric lighting stations where lamps are used at a considerable distance from the power source. It consists essentially of a fine platinum silver wire, one end of which is attached rigidly to one of the terminals of the instrument, and the other to a staff or pulley which by its rotation indicates the amount of expansion of the platinum wire due to the passage of the current. It will be seen that the heating effect, which very soon renders the coils of an instrument of the ordinary type useless, is the means here used to indicate the difference of potential. As no coils of any kind are used in this instrument, it can be applied to ascertain the potential of alternating as well as of direct currents without the introduction of any serious error due to self-induction.



FIGS. 1 AND 2.—ELECTRIC LIGHT AT THE LONDON INVENTIONS.

A Voltaic Cell with a Solid Electrolyte.

Writing in *Nature* recently, Mr. Shelford Bidwell expressed his belief that there has never hitherto been made a voltaic cell with a solid electrolyte which was capable of generating the smallest sensible current—at least at ordinary temperatures. Sir William Thomson found that when warm glass was placed between plates of zinc and copper, the existence of an electromotive force was indicated by an electrometer in connection with the metals, and Professors Ayrton and Perry extended the observation to the cases of paraffine wax, gutta percha, India rubber and shellac. But it is needless to say that with electrolytes of such enormous resistance no current could be generated of sufficient strength to be detected by any galvanometer, however delicate. He continued:

"On June 27 I exhibited to the Physical Society a little cell consisting of plates of silver and copper, between which was contained a mixture of one part of copper sulphide with five of sulphur. When this cell was connected with a reflecting galvanometer it produced a current by which the spot of light was at once deflected off the scale, copper being the positive pole. The electromotive force was found to be .07 volt and the internal resistance 6,537 ohms. The current, therefore, though far more than merely sensible, was small. Attempts were made to reduce the internal resistance by diminishing the proportion of sulphur contained in the mixture, but it appeared that as the sulphur was diminished the electromotive force was also diminished until, when there was no free sulphur at all, the cell failed to produce the smallest measurable current.

"It occurred to me that the sulphur owed its efficacy to the fact that it formed a film of silver sulphide upon the surface of the silver plate by direct combination. I therefore made a cell thus: A thin layer of copper sulphide was spread upon a copper plate and compressed into a compact mass against a surface of polished steel. A layer of silver sulphide was then spread upon the copper sulphide, and the cell was completed by pressing a silver plate upon the silver sulphide. The current which this cell produced through the shunted galvanometer was considerably stronger than that generated by the cell first described; but still the result was not quite satisfactory, and there seemed to be indications of short circuiting, which I thought might possibly be due to the penetration of particles of copper sulphide through the layer of silver sulphide. The silver plate was therefore removed from the cell, and, having been brushed over with a weak solution of sulphur in bisulphide of carbon, it was heated over a gas flame, and soon became covered with a uniform and continuous coating of sulphide. The heating was continued until all the free sulphur was evaporated. When the cell was reconstructed with this prepared plate it produced a current of

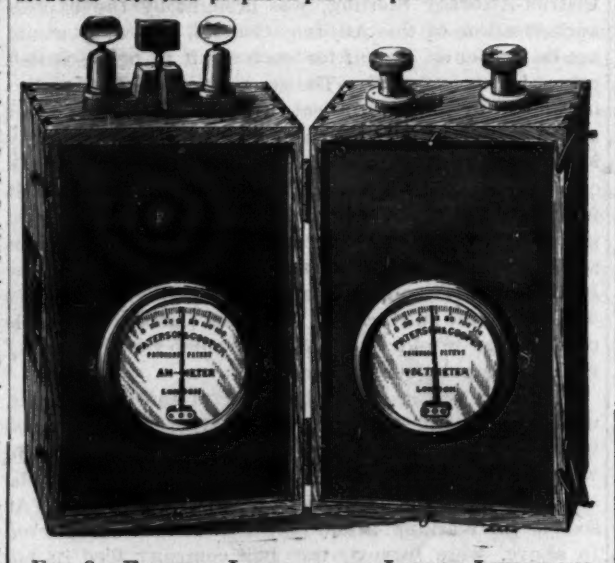


FIG. 3.—ELECTRIC LIGHT AT THE LONDON INVENTIONS.

6,800 micro-ampéres through an external resistance of .2 ohm, and was able to deflect the pivoted needle of an ordinary coarse galvanometer.

"The dimensions of the cell are as follows: The copper and silver plates measure 2½ inches by 2 inches; the thickness of the two layers of sulphide (strongly compressed) is about $\frac{1}{10}$th inch; the E. M. F. is .053 volt, and the internal resistance is therefore about 7 ohms.

"This cell seems to be exactly analogous in its action to a Daniell cell in which plates of copper and zinc are immersed in solutions of copper sulphate and zinc sulphate. Silver is probably the best (or only) possible metal for the positive plate, but some other metal might perhaps be substituted for the copper with advantage."

Prof. Sylvanus Thompson, writing on this subject, says: "Having been for some months occupied with the electrical behavior of the compounds of copper, silver and lead with tellurium, selenium, and sulphur, I can confirm the observation of Mr. Bidwell as to the behavior of sulphide of copper. He has constructed a primary cell with solid sulphides for the electrolytes. The smallness of the electromotive force which he has obtained is entirely due to the close proximity of copper and silver in the thermo-chemical series in respect to their heats in combination with sulphur. The theoretical electromotive force should be only .05 volt.

"Let me add to Mr. Bidwell's observation one of my own. If a piece of sulphide of copper is placed between platinum electrodes, a current of electricity from a battery can be passed freely through it, as it is a good conductor. But if after a time the battery is removed and the platinum electrodes are connected with a galvanometer, a current is observed. The solid sulphide between two platinum plates constitutes, therefore, a secondary cell or accumulator capable of being charged and discharged."

An Injunction Denied in the Stearns Duplex Case.

In a recent issue we gave a full account of the arguments of counsel in the Stearns duplex suit, in which the Western Union Telegraph Company sought an injunction to restrain the Baltimore & Ohio Telegraph Company from using their system. On Saturday last, Judge Wallace handed down his decision denying the injunction. It will be remembered that the B. & O. put in as a plea the non-validity of the reissued Stearns patents, together with that of non-originality, and in passing on these points, Judge Wallace says:

"Although as to the claims in controversy the second reissue must be held valid, that reissue in the form of three divisions containing nine claims in all was entirely unnecessary. The rights of the complainant were fully protected by the first reissue; the second must have been obtained upon the theory that the patent might be useful as a weapon of offense by means of claims so comprehensive and elastic as to embrace within their scope all subsequent inventions which might be made in the same field of improvement. Intermediate to the time of the first reissue and the application for the second reissue patents for cognate inventions were obtained by Thompson & Selden, F. W. Jones, and by Gerritt Smith. The reissue in suit was apparently designed to overreach these patents and subordinate them to the complainant's monopoly. The reissue is not to be criticised because the claims of the several divisions cover the invention of Stearns in the broadest form and in the narrowest form in which it is capable of use, but because it is upon its face a flagrant attempt to enlarge the scope of the invention in order that the patent might be more available in the suppression of all competing inventions. It is well calculated to mislead the public into the belief that the complainant enjoys practically the exclusive control of duplex and quadruplex telegraphy as used over long lines. A party seeking assistance of a court of equity appeals to the court to be astute to discover a legal right which has not been subverted in the justifiable attempt to encroach upon the rights of others. A complainant asking the protection of such a patent does not occupy an attitude which is commendable in the view of a court of equity. If the essential motive of those who represented the complainant in obtaining the reissue was to enable the complainant to assert a colorable title to an invention, to which all subsequent inventors must

pay tribute, this was an illegitimate and oppressive motive, and the Court should not be eager to come to their assistance when their patent is assailed, by granting them a remedy preliminary to final hearing. The patent, as reissued, is well calculated to suggest doubts as to its validity, and lead those who examine it to suppose that such an abuse of the statutory privilege cannot be tolerated. The officers of the complainant have only themselves to blame if others have acted upon the assumption that the patent cannot stand. The defendant has acted upon this belief. Under such circumstances the complainant should not have the stringent remedy applied for; and it is not only within the fair discretion, but it is the duty of the Court, to deny preliminary relief and leave the complainant to the ordinary relief at final hearing."

New Features of the Latest Telephone Litigation.

The greatest public interest appears to be felt in the suit instituted by the United States against the American Bell Company at Memphis, to set aside the Bell patent. We were the first to draw attention to the movements of the National Improved Telephone Company, and to publish the news of the suit, now the subject of universal comment, and brought on its initiative. It has now been discovered, although stated by us on various occasions, and more recently on the 12th inst., that Mr. Garland, the Attorney-General, from whose office came the instructions to bring suit, is himself interested, with other leading Democrats, whose names we have also given, in the opposition to the Bell patent, being a stockholder in the Pan Electric Company. This aspect of the case forms the subject of a long dispatch of Sept. 24, from Washington, as follows:

"The Pan Electric Telephone Company is one of the strongest and most powerful opponents of the American Bell Telephone Company. Its power and strength lie not alone in the capital which it can command, but in the commanding influence of its officers and promoters. One of the chief of these is A. H. Garland, Attorney-General of the United States. He subscribed for not less than $500,000 of its $5,000,000 capital stock. He has also been the company's attorney and 'legal adviser' since its organization. This telephone company has been engaged in protracted and unsuccessful legal contests with the Bell Company; so have a number of other companies which have been more or less leagued together against this, their common adversary. An extraordinary course has recently been adopted, under the authority of the Attorney-General himself, in his official capacity, to break down the Bell Company. This is the commencement of a suit by the United States Government to set aside the Bell patents.

"The Bell Company has gone through contest after contest against the infringers of its patents, and has been successful in every case. It is now suing the Pan Electric Telephone Company in some of the Southern courts. Just before the time arrives when the injunction is to be moved for against the Pan Electric Company and the other companies that are its licensees, the government suit is begun, in which all the old claims against the Bell patent that have been overruled in the litigated cases are again set up on the part of the United States, and a United States District-Attorney actually appears in court when the injunction motion against the Pan Company comes on for a hearing, and urges the court that it ought not to issue the injunction while the government suit is pending. The part that the Attorney-General has played in this extraordinary proceeding is not concealed in court. Although no mention is made of the fact that he is a very heavy stockholder in the chief company sought to be enjoined, it is openly stated that he has authorized the government suit, and that fact is itself used as an additional argument to persuade the court not to proceed against the defendant companies.

"The comments made upon the Attorney-General's course of action as the facts are gradually coming to light would interest not only him but all the supporters of the Administration responsible for his official conduct. The facts may be briefly told. The other chief promoters and officers of the Pan Electric Telephone Company, with Attorney-General Garland, were General Joseph E. Johnston, President, now United States Commissioner of Railroads; Isham G. Harris, of Tennessee, Vice-President of the company, and United States Senator; Casey Young, Secretary and Treasurer, formerly member of Congress for the Memphis District; J. D. C. Atkins, a director, now United States Commissioner of Indian Affairs; R. F. Looney, a director, and a member of the Democratic National Committee for Tennessee, and J. Harris Rogers, a director. All of the above have not held as large an amount of stock as the Attorney-General, but the amount held by each of the persons named was large.

"The new company was thus provided not only with an abundant amount of capital, but also with plenty of Democratic influence, from the Attorney-General down. It was incorporated in the State of Tennessee. J. Harris Rogers was formerly electrician of the House of Representatives when it was under the control of the Democrats, and it was upon patents obtained by him at that time that the Pan Telephone Company was organized. Soon after its incorporation the company began to sell territory in which the exclusive right to use its telephones was given, and the licensees or purchasing companies were guaranteed against loss by legal interference. One was organized in St. Louis, one in Memphis, one in New Orleans, one in Dallas, Tex., all of which paid considerable sums in cash besides giving the parent company a percentage of stock and a royalty for all telephones used.

"Two companies were also formed in Baltimore and Washington, with Bradley T. Johnson at their head, to control the States of Maryland and Virginia and the District of Columbia. A company was formed in Pennsylvania, in the establishment of which Congressman Klotz was prominent. Work was begun near Philadelphia, but the company was sued jointly with the Pan Electric Telephone Company, and the result was an injunction.

"The National Improved Telephone Company was formed in New Orleans upon some of Rogers' patents. The proceeding of the Bell Company against that company for an injunction was brought to a hearing before Judge McKennan, at Pittsburgh. Ex-Congressman Casey Young, who is an able lawyer, and Colonel George Gantt, of Memphis, after a meeting of the directors of the Pan Telephone Company, went by their authority to Pittsburgh to watch the progress of that case and to aid in the fight against the Bell Company. The ground taken by the opponents of the Bell Company in all these contests was that the principle patented by Bell was known and used in this country and Germany long before his patent was issued. If this could be established the Bell patent would fall; but their minor patents, which were claimed as subsequent improvements, might still stand. The result in this case was the same as in all the other many injunction suits brought by the Bell Company. The defendant brought in a book of affidavits to support its side of the case. Judge McKennan announced to the defendant the usual rule in such cases, that he would hear any new defense which had not been passed upon in the final decisions in other courts; that as he had himself heard the old defenses, he was satisfied that they were ineffectual. The judge found that the defendant had no new defenses, and so enjoined it.

"But the promoters of the Pan Electric Telephone Company were not dismayed. All of their resources had not yet been exhausted. Several of their officers were highly influential in Democratic politics and with the Administration. One of their principal stockholders was the Attorney-General. The powers of the Government itself might be employed against the Bell Company. A shrewd course was adopted.

"Henry McCorry, of Casey Young's own city, was appointed United States District-Attorney for the Western District of Tennessee. Mr. Young, Bradley T. Johnson and other members of both the Pan Electric Telephone Company and the National Improved Telephone Company had long consultations, the last one, it is understood, having been held recently in this city. On Sept. 6, ex-Congressman Young left Washington for Memphis, immediately after a three days' conference, and on September 10 United States District-Attorney McCorry brought suit in the United States District Court at that place, in the name of the United States as plaintiff against the American Bell Telephone Company and Mr. Bell, for the cancellation of their patents. This suit, as it was subsequently stated by District-Attorney Sterling, was brought by the express authorization of the Attorney-General, indeed, it would not be proper or regular for such a suit to be instituted except by his authority. The grounds on which it is asked in this suit by the government that the Bell patents be set aside are substantially the same which the Bell Company has successfully met in its contests with the other telephone corporations, and which are, therefore, no longer available to them. But if the government suit could be carried through, it would enable them to have all these questions tried over again, and if the suit should be successful the Pan Electric Telephone Company and all its satellites would reap the full benefit therefrom; and the probable consequence would be to make the chief stockholders of the Pan company very rich men.

"Another way in which the power of the government, used in this manner, may have been expected to be turned to the more immediate advantage of the corporation in which the Attorney-General is so largely interested will be surmised from the most recent court proceedings. As soon as the Washington and Baltimore companies, referred to above, were formed, the Bell company filed its bill in Baltimore and moved for an injunction there. In this suit the Pan Electric Company was the chief defendant, along with the Washington Telephone Company of Maryland, and various individuals. A delay was granted to the defendants until last Tuesday, when the motion came on to be heard before Judges Bond and Morris. Before the complainant's counsel had an opportunity to be heard, however, Gen. Bradley T. Johnson, as counsel for the defendants, objected to the hearing on the ground that Attorney-General Garland, in his official capacity, had caused a bill to be filed in the United States Court at Memphis in the name of the United States against the Bell Company of Boston, setting up all the numerous defenses to the Bell patent which have been passed upon in the various suits tried during several years, and asking the Tennessee judge to retry these defenses and decree the patent to be void. He was followed by District-Attorney Sterling, who appeared for the United States, under orders, as it was understood, from his superior at Washington, and who protested against any action by the court to protect the patent from infringement until the United States has retried the various defenses which had been passed upon heretofore. In the course of his remarks to the court the District-Attorney said:

"My brother thinks it strange that the Attorney-General of the United States, who, he admits, has authorized it, should spend the money of the United States on a bill which he says contains so many allegations which were disposed of in other cases, but such is the fact; and it is also the law that nobody but the United States can set afloat a proceeding the object of which is practically to attack the validity and existence of a patent. * * * It does strike me that when this proceeding is filed to set aside the patent, unless something is shown to the court, it must be treated as the act of the United States, and as long as that is pending in that way to declare the patent void, the court ought not to exercise its discretion against a bona fide business and grant a preliminary injunction."

"The judges, however, did not seem impressed by this view, and ordered the motion for hearing on Nov. 2, restraining the defendants in the meantime from increasing their business or putting out any more telephones."

This statement has been the subject of editorial notice in nearly every paper in the country, It was imperative that Mr. Garland should give an explanation in regard to the matter or in some way be vindicated of unfair motives by his friends, and Mr. Watson Van Benthuysen, of New Orleans, President of the National Improved Telephone Company of Louisiana, who was instrumental in bringing the suit against the Bell Telephone Company to have its patents declared void, has come forward in Chicago to make the subjoined public: "On July 12 last I wrote Attorney-General Garland requesting him to institute suit against the Bell Telephone Company under a law passed at the last session of Congress making it incumbent on him to proceed against patents issued fraudulently, or having fraudulent claims, at the request of any citizen. I charged that A. G. Bell was not the inventor of the telephone. Speaking telephones were invented previously by Reis, Vanderweyde, Pickering, Cross and Edison, and Bell was not the inventor of any telephone, and the Bell patents are not valid in whole or in part. I also charged that the Bell patent of 1876 is not being used; that it is without value, and that the transmission of speech at the present day by the Bell Company is by the use of what is known as the Blake transmitter, which was an infringement of the Edison patent, which latter patent Edison claimed was an improvement on Reis's, and that the Blake transmitter was largely in use in this country three years before being patented, and therefore the patent was void. I charged further that vocal and other sounds were transmitted telegraphically long before Bell was heard of. I therefore requested that proper proceedings be had to relieve the people of the great wrong perpetrated in the issue of claims giving to these patents the exclusive right to transmit articulate speech by electricity, asking that such proceedings should be instituted in Memphis before Judge Hammond. It turned out, however, that there was no such law as that referred to. It passed the House, but disappeared after reaching the Senate, and is supposed to have been stolen. So I withdrew the letter and followed the provisions of the statute.

"The attempt of the Bell Telephone and Western Union Telegraph monopolies," continued Mr. Van Benthuysen, "to make it appear that Attorney-General Garland had given the permission to institute the government suit against the Bell Company in Memphis, and that it was improper for him to do so, because he is connected with a competing telephone company, is characteristic of those two concerns. Mr. Garland did not grant the permission. He was not in Washington. He was out in Arkansas somewhere when permission was granted. I had first made written application to have this suit instituted direct to the Department of Justice. After I ascertained that the statutes provided a different course from that I have outlined, I then, with the assistance of others, presented the case to Judge McCorry, District-Attorney at Memphis, giving him overwhelming evidence that Bell did not invent the telephone, nor did he discover the art of transmitting speech by electricity. These proofs were so convincing that Judge McCorry immediately laid them before the Department of Justice, and asked permission to institute the suit, which was promptly granted. We then applied to have four attorneys appointed special government attorneys to assist, and J. R. Beckwith, George Gantt, Col. Casey Young and Gen. Wright were appointed. The permission to institute the suit was given by the Acting Attorney-General during the absence of Mr. Garland. If Mr. Garland had been present and had refused to grant permission because of his personal relations to another telephone company, it would have been a great wrong and imposition that he should permit his private affairs to prevent his performing a duty to the public. The Pan Electric Telephone Company has no interest in the National Improved Telephone Company, and the suit at Memphis was petitioned for by citizens and not by telephone companies, and the expense attending it is provided for by subscription. Not a single man who is mentioned as having stock in the Pan Electric Company signed the petition for the suit. The Associated Press dispatches from Memphis when the suit was instituted were suppressed. The Bell attorney threatened me with serious consequences for attacking the validity of the Bell patents

and then lied about it, and now they object to being made defendants in a court of justice, wherein there will be no opportunity for their peculiar tactics, which make them more dangerous to the liberties of the people than a standing army."

Not satisfied with getting the public ear by means of the press, Mr. Benthuysen has now addressed President Cleveland, asking him to give his attention to the matter in order that "no further wrong" may be done.

The Proportions of Light and Heat Emitted by Incandescent Lamps.

An investigation has been made by Herr W. Peukert, at the laboratory of the Technical High School of Hanover, for the purpose of determining how much of the electrical energy supplied to different types of incandescent lamps reappears as light and heat respectively. In these experiments the heat evolved from the lamps was ascertained by registering the rise in temperature of a weight of water in which they were immersed for a stated time. The photometrical measurements were made by the aid of Von Hefner-Alteneck's normal flame. The illuminating power of the various lamps experimented upon was recorded while they were immersed in water as well as when hanging in air, the loss of light in the former case being from one twenty-fifth to one-eighth with different lamps. As the result of Herr Peukert's examination, it appears that in one of Siemens and Halske's 8-candle incandescent lamps, 74 per cent. of the total work of the current was lost as heat, while 26 per cent was represented by the light emitted. With Edison's 16-candle lamp, 66 per cent. of the current was returned as heat, and 34 per cent. as light. In Swan's 30-candle lamp, 72 per cent. of the current was transformed into heat, and 28 per cent. into light.

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER V (*Concluded*).

ELECTRIFIED SPHERES.—Let two insulated metal spheres of equal size and similarly charged, be placed in contact, as represented in Fig. 13. It is evident that either of them,

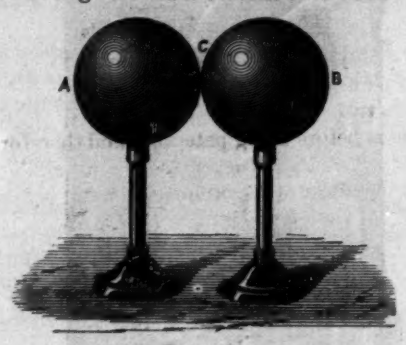


FIG. 13.

separately, would fulfill the conditions just named; but, when placed in contact, they must be regarded as one mass, having its centre at the point of contact; the electric distribution being the same on each.

Hence the forces of induction and repulsion which before acted to remove electricity from the centre of the single sphere to the parts most remote from it—that is, to the surface—now act in the same manner to remove electricity from this new centre to those parts of the mass most remote, that is, to the points *A* and *B*, and the surfaces surrounding them.

There must also be a certain amount of electricity distributed over the entire surface of each sphere, and there must be repulsion between the surfaces adjacent to the point of contact; so that the charge will be zero at this point, and increase each way toward *A* and *B*.

This may be demonstrated by touching the points *A*, *B* and *C* with the proof plane, and, after each contact, bringing it near the disc of the electroscope, taking care to discharge it with the finger before making the next test.

It will be found that the central point shows scarcely a trace of electricity, while the points *A* and *B* are strongly electrified. This same test, applied to intermediate points, shows the charge on them to be in proportion to their distance from the central point.

ELECTRIFIED CYLINDER.—Instead of the two spheres, we may substitute an insulated metal cylinder with hemispherical ends, provided with pith ball electroscopes at the ends and centre, as represented in Fig. 14.

A light charge of electricity on the cylinder will cause the balls at the ends to diverge in opposite directions, while the central ball will remain unmoved or but slightly affected, showing that the principal part of the charge is condensed on the ends, and that induction and repulsion are operating to remove electricity to the points farthest from the centre, as shown by the position of the balls at the ends.

If a sphere be made to oscillate near one of the balls at right angles to the length of the cylinder, the effect of induction will be shown by the ball following the movement of the sphere.

INFLUENCE OF POINTS.—If a cylinder having cone-shaped ends be substituted for the one with hemispherical ends dissipation of the charge, instead of condensation, will occur. For, on the hemispherical ends, the charge is retained by the resistance of the air on the surface; but the cone-shaped ends terminate in points which have no surface, hence there can be no resistance.

But if resistance is removed, even from a single point, it is evident that the entire charge must pass off through that point; since the removal of electricity from any point on a surface creates a difference of potential between that and surrounding points, producing an electric movement in the direction of the point of no resistance, which must extend to every part of the surface and continue till equilibrium is restored.

Instead of the cylinder with cone-shaped ends, we may

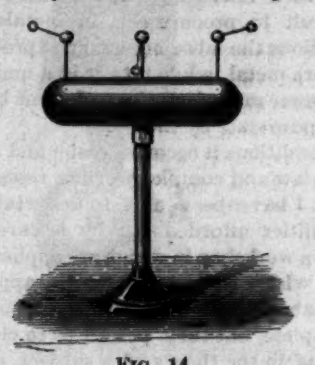


FIG. 14.

use one with needles attached to the ends, as represented in Fig. 15. A wooden cylinder covered with tinfoil can easily be changed in this way.

It will be impossible to charge such a cylinder even if only a single needle be attached to any part of the surface. A projecting angle on any part of a conductor will tend to produce the same result.

Effects somewhat analogous to these may be obtained by dipping into water a spherical body and a sharp-pointed spike having the same amount of surface. On lifting out the spherical body, water will adhere to it and collect in a large drop at the lowest part, being held there by adhesion and atmospheric pressure.

But if the spike be lifted out, point downwards, the water will drop off when it reaches the lowest point,

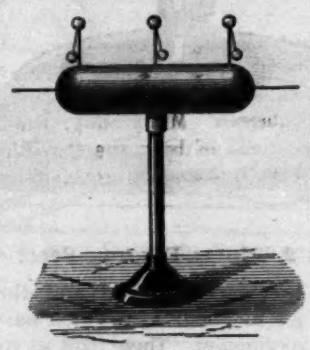


FIG. 15.

there being no surface there on which it can be retained by those forces.

ELECTRIFIED SPHEROID.—If a metal sphere be flattened at the poles till it assumes the form of an oblate spheroid, as shown at *A*, Fig. 16, the face of a cross section through the poles, as shown at *B*, will have the same form as a cylinder with hemispherical ends.

And since it has been shown that a charge of electricity on such a cylinder is condensed on the ends, it is evident that a charge on such a spheroid will, in like manner, be condensed on its outer edge.

ELECTRIFIED DISC.—If a flat metal disc with a thin edge be electrified, the charge will go to the outer edge,

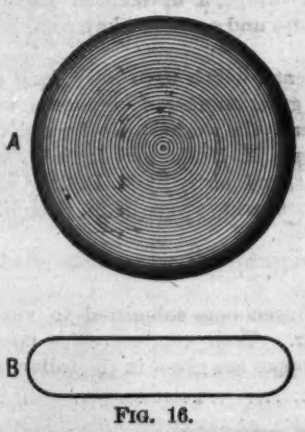


FIG. 16.

as in the last case. But resistance, being in proportion to surface, is very small on such an edge, and the charge is rapidly dissipated.

Hence such a disc, when constructed for the purpose of condensing electricity on it, should be provided with a round rim, which may be called a *resistance rim*.

If such a disc be insulated, and there be placed on its opposite sides, near the edge, two little metal stands with pointed stems, on which are balanced light metal poin ers, having arms of unequal length, as shown in Fig. 17, a charge of electricity given to it will cause the pointers to arrange themselves in the direction of the radii, showing that the electric force is from the centre outward.

(TO BE CONTINUED.)

Bankers & Merchants' Mortgages.

It seems likely that the telegraph litigation will be revived, as opposition is now being made to the foreclosure of what is known as the divisional mortgage upon the property of the Bankers & Merchants' Telegraph Company between this city and Washington. That mortgage amounts to $300,000. A motion was made and argued on September 23, in the suit for the foreclosure of this mortgage, which is brought by the Farmers' Loan and Trust Company, as trustee, on behalf of the United Lines Telegraph Company as the successor of the Bankers & Merchants', and by John G. Farnsworth, as receiver of the latter company, for leave to come in and defend the action to foreclose. Ex-Senator Roscoe Conkling, Edward S. Lauterbach and William N. Cohen appeared in support of the motion, which was opposed by Herbert B. Turner, S. B. Brownell and William G. Lathrop. This divisional mortgage, which was made prior to the general mortgage of $10,000,000 under which the Bankers & Merchants' property was sold, was executed on July 2, 1883. Over $700,000 of receivers' certificates had been issued, and Farnsworth became largely indebted, among others to Edward S. Stokes for over $80,000. The proceeds of the property are insufficient to meet the receivers' certificates and the other indebtednesses, and a large deficit exists. More than $50,000 was expended in the preservation of the property covered by the divisional mortgage. While the receivers were in possession the receipts from the property were not sufficient to cover the outlays.

In support of the motion, it was claimed that the interest upon the divisional mortgage became due last January, but no demand for its payment was made. The action to foreclose was begun in April last, without making Receiver Butler a party to the proceeding. and it has since continued without adding any party to the action except the Bankers & Merchants' Company, which, it is alleged, as a corporation had no particular interest in protecting the rights of the bondholders or others. It was asserted that no demand for interest upon the mortgage was made upon the receiver, and that if it had been, an effort would have been made to have applied the money for the payment of the interest sooner than have allowed the foreclosure suit to have been brought. Mr. Lauterbach took the ground that the

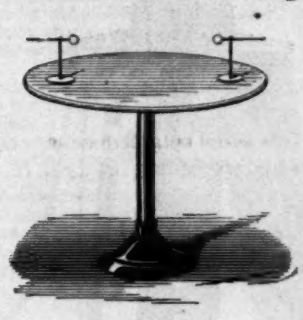


FIG. 17.

receiver should have had intimation that default had been made in the payment of the interest, and he asked the court to permit the receiver and the United Lines Company to be made parties, so that they can defend the action, and to order that no action be pressed for the foreclosure of the principal, which he claims is not yet due, but for the foreclosure of the interest. He further contended that the mortgage upon the property had never been properly recorded or acknowledged, except in New York, and that many of the bonds had been issued with-without valuable consideration.

The motion was opposed upon the ground that it was made without any foundation for it; that a demand had been made for the payment of the mortgage coupons, but no payment was made, and that the principal of the mortgage was due, and the action had been properly brought.

Judge Barrett granted the motion to permit the receiver and the United Lines Company to be made parties to the suit for the foreclosure of the divisional mortgage.

The Besspool Electric Tramway.

This English road has been inspected and passed without alteration by the government authorities. It has been constructed to form a link between the mills and granite quarries of the Bessbrook Spinning Company and the railway at Newry, the distance between the two places being three miles, and the annual traffic, which has hitherto been carried in carts, being about 28,000 tons. The tramway differs from others in that the vehicles are equally well adapted to run on the rails and the ordinary roads, this facility being required by the difficulty which was found in connecting the line to the railway at one end, and to every department of the works at the other. They are carried on four wheels 2½ inches wide and without flanges; the first pair are on a bogie which can be fixed to form a rigid wheel base, or have shafts fitted to it, and allowed to swivel after the manner of the leading axle of a coach. These wagons carry two tons each, and can be drawn by a horse up moderate hills. On the outside of the ordinary tramway rail, second rails have been laid, to which the ordinary rails act as guards. The flangeless wheels run upon these outside rails. The maximum gross load of a train is 26 tons, consisting of six wagons, which

carry about 2 tons each, and the electrical locomotive, weighing 8 tons, which also forms the passenger carriage, and is capable of accommodating 34 passengers. This load can be drawn up inclines averaging 1 in 85 at a speed of seven miles an hour, and up the stiffest incline of 1 in 50 at a speed of six miles an hour. The train can be started at any point of the line without difficulty. The motive power is electricity furnished by dynamos situated about two miles from Newry, at Millvale, and driven by a turbine, constructed capable of developing 65 horse-power. The conductor consists of an inverted steel channel carried on insulators, and fixed midway between the ordinary rails. Both the generators and motors are of the Edison-Hopkinson type, constructed by Messrs. Mather & Platt, and are capable of developing 25 horse-power. The engine is geared to run at a maximum speed of fifteen miles per hour, and this speed is easily attained when there are no trucks attached. The cars are 35 feet long over all, and are carried on bogies at each end, so that they pass readily around curves of 55 feet radius.

A Novel Electric Bell and Automatic Cut-Out.

Although innumerable forms of electric bells have been designed, we still find new ones appearing. Our engravings, Figs. 1 and 2, represent a new and ingenious system, known as the Jensen, which has recently been brought out by Messrs. Woodhouse & Rawson. A bell having the form of an ordinary church bell is used, and inside is placed a single solenoidal magnet of special construction, in which the armature, besides being magnetized by induction, is directly polarized by being in actual magnetic contact with the iron core of the magnet. It is thus induced to perform a large amount of work with a comparatively small E. M. F. These bells produce a musical tone instead of the harsh sound heard upon the ordinary English gongs. They can be attached to a wall or any projection in any position, the usual case containing the magnets being, of course, dispensed with. Figs. 1 and 2 show two forms of the bell.

In order to avoid the use of fusible plugs, Mr. Cunning-

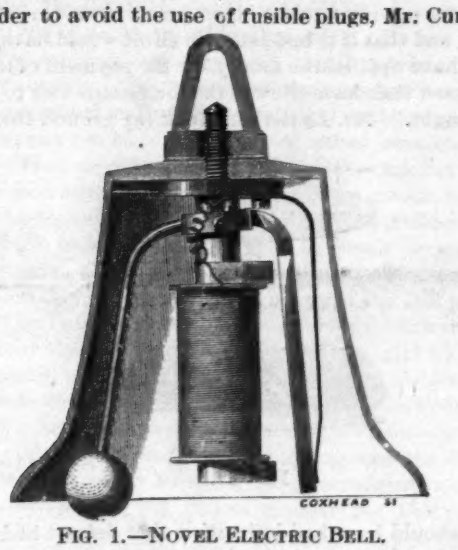


Fig. 1.—Novel Electric Bell.

hame, in connection with Messrs. Woodhouse & Rawson, has devised an automatic cut-out which is now being used by the latter in all cases where it is required to sever or make an electric connection when the current or E. M. F. exceeds or falls below a given strength. Its action depends upon the raising of an armature against the action of gravity when the current passing round a small coil exceeds what the instrument was adjusted for. On the armature being drawn up, it draws two copper legs out of two mercury cups and thus severs the connection. The moment before the connection is severed, the armature falls over by its own weight to the other side and completely breaks the circuit. Two legs can be put on to the other side to fall into mercury cups and put in a resistance, ring a bell or do any other work required. A small screw enables the instrument to be set for any current which the size of the wire on the coil allows. A touch of the finger, or a mechanical arrangement to act after a few moments, restores the connection when it is broken. In fixing the instruments, the only precaution needed is to level them; they will then remain in perfect order for years. Little or no electric energy is consumed or lost by the apparatus. The advantages of an efficient automatic cut-out in connection with ship lighting are particularly apparent, and a special form in which a spring action is used in the place of gravity, is made for such purposes. The cut-out is illustrated in Fig. 3.

Electric Conductivity of Metals and their Alloys.*

BY M. LAZARE WEILER.

In the study of all electrical problems, and especially of such as relate to dynamic electricity and its applications, we are brought at the outset to the consideration of conduction.

Whether it be a question of light, of force, of heat, of chemical or mechanical phenomena, or, in a word, of any transformation whatever of electricity, it is indispensable to know the quantity of electricity produced at the source, and the amount afforded at the place where it is utilized.

The nature of the intervening conductor becomes, then, one of the principal elements of the problem.

In the dynamo-electric machine, which is a only a con-

* Abstract of paper read before the *Société Internationale des Electriciens.*

ductor or a series of conductors subjected to magnetic induction, the property of conductivity is an important one.

The properties, therefore, of different metals and their alloys, as regards their power of transmitting electricity, afford a subject of exceeding interest.

This question furthermore merits our attention now, for the reason that physicists who have heretofore investigated it have failed to arrive at concordant results, either because of the impossibility of obtaining absolutely pure metals, or by reason of the imperfections of the apparatus or the methods for electrical measurement at the date of their researches.

When Mathiessen made his experiments (1863), it was extremely difficult to procure certain metals in a pure state. He mentions the labor necessary to produce 5 or 10 kilograms of pure metal, while now it is a matter of daily occurrence in some manufactories to deposit by electrolysis, metals in a pure state by the ton.

Under such conditions it becomes easier and all the more necessary to review and complete former researches. This is the work that I have been able to undertake by aid of the special facilities afforded me by a carefully fitted laboratory, and a workshop in which are applied, on a large scale, processes which were not formerly applied outside the chemist's laboratory. The results obtained are far from being complete, but they permit us to closely examine certain points in the theory of a subject upon which our ideas are not yet conclusively formed. They afford in all cases useful corrections to the published tables, which are for the most part afflicted with errors.

An examination of these tables shows a want of accordance, not only in the relative conductivities of the different metals, but also in their order. Thus silver occupies the third place in the table of the elder Becquerel, whereas it should have been in the first. Also palladium is in the first place in Pouillet's table, while it should have been placed last.

These differences justify the new researches, which are furthermore prompted by that desire for precision which the daily progress in the practical application of electricity renders necessary.

I now proceed to present a *résumé* of my researches in

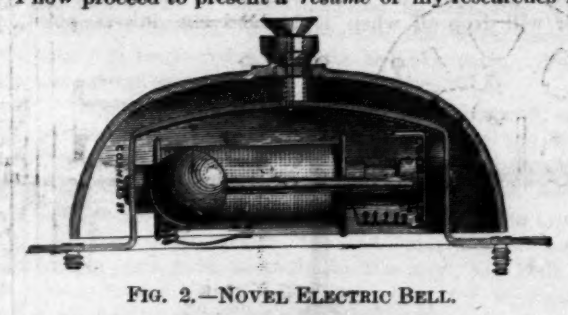


Fig. 2.—Novel Electric Bell.

determining the resistance of metals and alloys. I shall hand to you a set of small bars which have been prepared for these experiments. These bars, as you see, have been cast with a diameter of about 13 millimetres. They have been cut in such a manner as to exhibit the grain of a fracture, and the detached portion has been drawn into wire, upon which the experiments now to be decribed were tried.

In case of the alloys which cannot easily be drawn or rolled, as some of the compounds of silicon and phosphorus, the experiments have been tried directly upon the bars themselves by the method of Sir William Thomson.

In conducting the experiments, the bars were supported on V-shaped rests, placed at a constant distance apart. These rests were respectively in communication with two resistances composed of two parts, of which one is one-thousandth of the other.

A Wheatstone bridge, a differential galvanometer, a battery of four cups and a contact-key complete the apparatus.

The measurements, which were very long and minute, and made upon a great number of specimens, were made in part by the writer at the workshop in Angoulême, with the assistance of Messrs. X. Muller and J. Stahl, engineers of the establishment, and partly by M. Duflon, electrical engineer in the measuring-room of M. Sciami, director of the Maison Breguet.

These latter experiments were those made upon the bars themselves.

The number of specimens submitted to your examination is thirty-four. Their conductivities compared with silver and pure copper are given in the following table:

Silver	100
Copper, pure	100
" refined and crystallized	99.9
Bronze, siliceous, telegraphic	98
Copper and silver alloy, equal parts	86.65
Gold, pure	78
Copper with 4 per cent. of silicon	75
" " 12 " "	54.7
Aluminium, pure	54.2
Tin with 12 per cent. of sodium	46.9
Siliceous bronze, telephonic	35
Copper with 10 per cent. of lead	30
Zinc, pure	29.9
Phosphor-Bronze, telephonic	29
Brass, siliceous, 25 per cent. of zinc	26.49
Brass with 35 per cent. of zinc	21.5
Tin phosphide	17.7
Gold and silver alloy, equal parts	16.12
Swedish iron	16
Tin, pure, banca	15.45
Antimony-Copper	12.7
Aluminium-Bronze	12.6
Siemens steel	12
Platinum, pure	10.6
Copper with 10 per cent. of nickel	10.6
Cadmium, 15; mercury, 85	10.2
Bronze, mercurial, dronier	10.14
Arsenical copper, 10 per cent. arsenic	9.1
Lead, pure	8.88
Bronze containing 20 per cent. tin	8.4
Nickel, pure	7.89
Phosphor-Bronze with 20 per cent. tin	6.5
Copper with 9 per cent. phosphorus	4.9
Antimony	3.88

A large number of experiments were tried upon alloy and compounds not represented in the above series.

It will be observed that in the results recorded above resistances are not given in ohms, but conductivities are expressed relatively to a selected standard, which is pure silver. A wire of this metal, one millimetre in diameter, offers a resistances at 0° Centigrade of 19.37 ohms per kilometre.

Pure silver and pure copper are the best known conductors of electricity. The ease with which silver can be obtained in a pure state would seem to entitle it to the position of standard of comparison. It also oxidizes with greater difficulty than copper, and its oxide is a better conductor. In this last peculiarity, there is less chance of error when comparisons are made with silver for a standard.

Gold has a conductivity of 78. The alloy of gold and silver calls attention to a remarkable fact. When silver is alloyed with a small percentage of gold, the conductivity immediately diminishes. Two per cent. of gold is sufficient to reduce the conducting power from 100 to 60. An increase in the proportion of gold, however, is attended with a decrease of conductivity at a less rapid rate, the minimum of 16.12 being the conductivity of an alloy of equal parts of gold and silver.

If the varying conductivities of the different proportions of gold and silver alloy be represented by a curve, it will be found to take the form of a parabola whose axis is per-

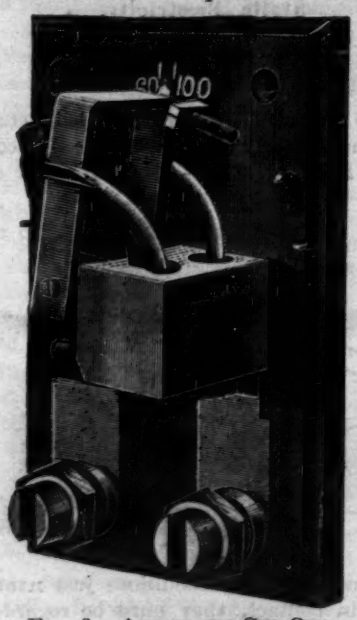


Fig. 3.—Automatic Cut-Out.

pendicular to the axis of X; the curve descending from the ordinate 100 for pure silver to 16.12 for the alloy of equal parts of the two metals, and rising to 78 for pure gold.

This singular phenomenon seems to indicate that a kind of interference is produced analogous to that when rays of light partially extinguish each other by superposition. This is not an explanation, but a simple analogy.

It should be remarked, however, that it is not true, though sometimes asserted, that in an alloy the electric conductivity is always lower than that of the poorest conductor of the constituents. It is simply demonstrated that the union of two bodies modifies to a great extent their separate conductivities, and this fact ought certainly to lead some time to interesting results.

In examining the foregoing table, we find platinum with a conductivity of 10.6. Aluminum, which is distinguished from the other metals by its want of density, has the considerably higher conductivity of 54.2. This is partly compensated for by its low specific weight. But it is a mistake to consider its lightness as a quality fitting it some day for aërial telegraph lines. Its tenacity is rather feeble, and its tensile strength falls from 10 kilograms per square millimetre in the hard metal, to 6 or 7 kilos only in the annealed metal.

Iron, steel, lead, zinc and tin possess low conducting powers, and the results in the table are not insisted upon. It is sufficient to consider them in connection with results previously found.

Copper, however, is to be regarded with interest and care, as it, with its alloys, is regarded as the typical conductor of electricity. It possesses, when unalloyed and is free from its oxide, a conducting power equal to silver. Its cost is low enough to render it available for industrial uses. It is malleable, and some of its alloys possess a remarkable tenacity.

We have completed the observations which we set to present to you, and which, as you see, form a pr gramme of researches to be made quite as much as of re sults accomplished.

We wish especially before closing to call attention t

the double interest attaching to the subject which has enlisted your attention. From the practical point of view alone the subject is of the highest importance, as has been shown by the results obtained, bearing as they do upon the vast problem of transmission of electric energy.

But we do not insist upon this point. The estimate of this subject from the scientific stand-point is no less great, involving as it does the nature of electricity itself.

Among the facts which we have noted we will refer again to the strange anomaly exhibited by the alloys as conductors of electricity, when we consider them as compound substances. This might serve as an occasion to review the theories promulgated by certain eminent physicists—Clerk-Maxwell, among others. But these theories are yet such mere hypotheses, and their interpretation appears to me so abstract, that I fear to venture upon this ground.

But there is no rashness in affirming that in the resistance offered by a body to the electric current, the magnetic orientation of the molecules of each body plays an important part. Each of them, influenced by the passage of the current to a degree probably depending upon its constitution, modifies the resistance.

The question may be asked whether the compound molecules of the alloys do not behave as other elementary electric couples, having a special electromotive force that determines the passage of the current, and which produces in the total mass a series of currents analogous to the so-called Foucault currents, the effect of which is contrary to that of the primary current.

We are tempted to believe that in the alloys the chains of molecules of the same kind are not able to act like a cable made of wires of different metals. As the alloy of equal parts of gold and silver has already been referred to, let us determine the re istances under the different conditions. If the current be transmitted through two wires each a kilometre long and a millimetre in diameter, one being of gold and one of silver, the formula for derived currents enables us to determine the total resistance. The formula is:

$$x = \frac{R_1 R_2}{R_1 + R_2}$$

The resistance of the silver being 19 ohms, and of the gold 24.36 ohms, the total is, by the above formula, 13.38 ohms.

But a wire made of the alloy in these proportions, having the same length and a double cross-section, offers a resistance of 58.50 ohms.

This result shows that the law governing derived currents does not apply in the case of conduction through alloys.

Some other cause intervenes; possibly such a one as is mentioned above; perhaps an unknown cause which essentially modifies the flow of electricity.

We may be permitted to recommend this investigation to physicists, and we are ready to devote our efforts to the same end.

If this task, to the accomplishment of which we wish to dedicate ourselves, is crowned with success, we shall be sufficiently recompensed by the satisfaction which labor affords to those who seek thereby to advance science.

An Electric Bell of New Design.

Our illustration represents an electric call-bell which has been constructed with the object of obtaining the best effect by careful adjustment. As will be seen, the vibrating armature is pivoted at its end, and is drawn away from the electro-magnets by a spring finger which runs at right angles to it, below the magnets. In addition, the armature carries a three-fingered contact spring by which the makes and breaks are effected with the least sparking possible, and which prevents burning. Both the springs are provided with thumb-screws, by which they can be adjusted so as to give the maximum effect. From the construction of the bell, it is evident that it works satisfactorily in any position. Messrs. E. S. Greeley & Co., of this city, have lately undertaken its manufacture.

A Simple Domestic Motor.

BY F. H.

I frequently receive inquiries for directions in regard to the construction of a simple electric motor for very light work, and in answer to these I give the following details, which will enable any one to construct such a one at very small expense.

In the accompanying illustration the spool *a* is made of wood, 5 inches long, 2 inches diameter of flanges, 1 inch outside diameter of core and ¼ inch hole. This is closely wound with 4 pounds of No. 10 B. & S. gauge, cotton-covered wire. The spool is fastened to the base by means of screws which pass into the flanges. The base is of hard wood, 8 × 15 inches and ½ inch thick.

Six inches from the spool. and in line with it, the stud *c* is screwed to the board, and upon it the fly-wheel *d* revolves. The fly-wheel has a crank pin *e*, placed one inch from the centre. On the rear side of the wheel there is let into it a semi-circular ring of hard rubber ½ inch wide and ¼ inch outside radius.

Two brass springs *g g* are screwed to the base, one of which is so placed as to bear directly on the ring, while the other is placed just outside of its reach, so that it is always in contact with the metal of the wheel. The ring is best secured to the wheel by screws which come through from the other side, so that the threads alone hold the ring. Care must be taken, however, that the screws do not pass entirely through.

To the crank-pin *E* there is fastened an iron rod *f*, 14 inches long and ¼ inch in diameter. One end of this is flattened and has a ¼ inch hole drilled through, so as to fit the crank-pin. When putting the motor together, the spool, should it require adjustment, can be raised by placing strips of wood under it, until the rod passes freely in and out. When the correct height is reached all may

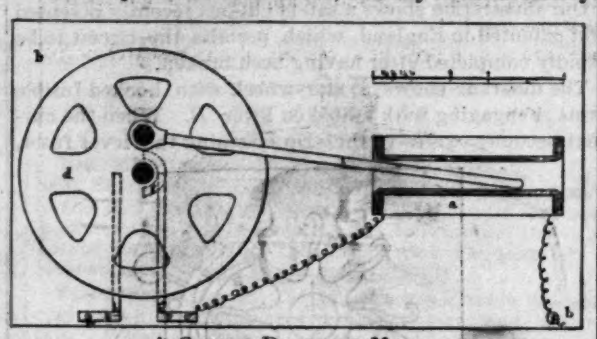
TRIPLE CONTACT BELL.

be screwed fast. Wires from a battery are led to the springs, as shown.

The action of the motor is apparent. In the position shown in the sketch, the current is interrupted, but as soon as the wheel has made a quarter revolution, both springs are in contact with the metal of the wheel, the current passes, and the rod is drawn into the solenoid. During the next half-revolution or return-stroke, the current is again interrupted and the momentum of the wheel drives it. This operation is repeated continuously.

Two or three bichromate cells are sufficient to run the motor at a good speed so as to drive a sewing machine, fan or other light piece of machinery.

All of the parts can be obtained, and any of the necessary



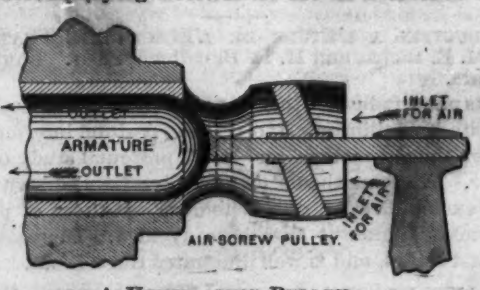
A SIMPLE DOMESTIC MOTOR.

work done, at any sewing machine repair shop, so that the cost will be very low.

A Ventilating Pulley for Dynamos.

The problem of keeping the armatures of dynamos cool was formerly quite an important one, but has now little significance. This has been brought about by the fact that dynamo makers, having studied their machines, have now arrived at proportions which leave the running armature practically cool. Indeed a machine which would require much artificial ventilation could justly be designated as a bad one. Nevertheless even well designed armatures are apt to heat somewhat with continuous service, so that a simple ventilating device might be added with propriety.

The accompanying illustration shows a method sug-



A VENTILATING PULLEY.

gested by a correspondent of an English contemporary and which can be easily applied even to existing machines. It consists in supplying a pulley with spokes similar to the fans in a ventilator. An extension from the edge of the pulley to the pole pieces compels the air to pass around the armature and prevents its escape to the side. The device is a very simple one and would appear to be quite effective.

The Averell Insulating Conduit.

The recent announcement that the Baltimore & Ohio Telegraph Company were experimenting with the Averell Insulating Conduit Company for the purpose of putting its wires underground in the city of Washington, has drawn attention to the system which it is proposed to employ.

The conduit, as its name implies, serves not only as a receptacle for the wires, but is designed to be the insulator in addition. The conduit is built up of a composition consisting of pure silica and asphaltum, which combine intimately and form a concrete impervious to water, heat or other atmospheric changes.

As the conduit itself is the insulator, none but bare wires need be used, except for terminals, or when it is given a tubular form, when specially insulated wire would be used.

An experimental prism of this concrete 450 feet long and 10 inches square in cross section has been laid two feet underground in the city of Washington for over one year. It contains seventy naked copper wires, the aggregate length of which is about six miles. It has been repeatedly tested during this time, and the resistance which its insulation has offered to the greatest electrical energies that could be brought to bear upon it from batteries and dynamo machines is said to be very satisfactory.

The conduit is laid by machinery, the first of which is now in use. By this machine 10 lineal feet can be laid per minute.

The Averell Insulating Conduit Company, of Washington, D. C., is now executing a contract with the Baltimore & Ohio Telegraph Company to lay its northern telegraph circuit underground and the dimensions of which are: Length one and a half miles, containing 60 conductors of an aggregate length of over 60 miles. When this contract is completed the company will bury the southern circuit of the Baltimore & Ohio Telegraph Company in Washington.

Besides the claim for efficiency which is made for this system, its small cost is urged in its favor.

A Marvelous Development of Incandescent Lighting.

Few instances of growth in this country can equal the remarkable development of the Edison system of incandescent lighting.

A striking evidence of the ever-increasing popularity of the incandescent light as an illuminant will be found in the following analysis of the business of the Edison Company here, to say nothing of its immense and growing popularity abroad:

PLANTS ESTABLISHED FOR AND OWNED BY PRIVATE USERS.

	Plants.	Lamps.
Educational institutions, public asylums and hospitals	26	7,173
Hotels, apartment houses and club rooms	23	11,035
Theatres and places for amusement	20	14,033
Banks, office buildings, stores, residences, etc	73	23,757
Newspaper and other printing offices	30	6,521
Sugar refineries	11	4,864
Flour mills and grain elevators	26	1,934
Cotton, woolen and textile fabric mills	81	25,898
Pulp and paper mills	30	3,318
Oil refineries, distilleries, dye houses, chemical works and meat-packing houses	29	3,392
Water-works, rubber factories and miscellaneous manufacturing establishments	39	5,088
Iron-works, car and machine shops	40	7,828
Furniture and piano-forte manufactories and wood-working establishments	15	2,360
Steamships, steamers, yachts, etc	51	8,092
Grand totals	494	125,293

All these, it should be borne in mind, are owned and operated by the purchasers themselves.

The central lighting stations, operated by the company, and devoted wholly to the work of supplying lights to the general public precisely after the manner of gas, are as follows:

New York, N. Y.;	lamps	supplied	13,000
Bellefonte, Pa.;	"	"	1,200
Middletown, O.;	"	"	700
Williamsport, Pa.;	"	"	4,500
Piqua, O.;	"	"	1,200
Newburg, N. Y.;	"	"	3,000
Tiffin, O.;	"	"	1,200
Fall River, Mass.;	"	"	3,000
Hazleton, Pa.;	"	"	1,200
Lawrence, Mass.;	"	"	4,500
Shamokin, Pa.;	"	"	3,000
Brockton, Mass.;	"	"	3,000
Circleville, O.;	"	"	1,200
Cumberland, Md.;	"	"	1,200
Des Moines, Ia.;	"	"	2,000
Appleton, Wis.;	"	"	2,000
Harrisburg, Pa.;	"	"	5,000
West Chester, Pa.;	"	"	2,000
Johnstown, Pa.;	"	"	1,200
Tamaqua, Pa.;	"	"	2,000
McKeesport, Pa.;	"	"	2,000
N. Brunswick, N. J.;	"	"	2,000
Boone, Ia.;	"	"	1,000
Wilmington, Del.;	"	"	2,000
Total			51,400

This makes a grand total of 167,000 lamps.

Such facts and figures speak for themselves, and will demonstrate the possibilities and achievements which are in store for the system of incandescent electric lighting.

The Telephone in New England.

The New England Telephone directors have postponed the consideration of the dividend question till the monthly meeting of Oct. 28, but it is understood that no dividend can be paid this year, and only a small one hereafter, unless the Bell Telephone Company makes further concessions in royalties, or raises dividends upon its stock.

There will be $7,812,600 of dividend-drawing capital in New England Telephone after Jan. 1, 1886. The net earnings above construction for the last six months reported amounted to $92,000, or at the rate of $184,000 per annum. Deducting $40,000 for annual taxes, there remains but $144,000 for annual division among stockholders, which amounts to less than two per cent. per annum upon this dividend-drawing capital, and the dividend-drawing capi-

al increases by $600,000 every Jan. 1, until all the stock issued participates in dividends.

Some of the Erie Telephone contracts expire this year, and several in 1886, and the Lowell outcry against the American Bell Telephone Company is, it is alleged, largely for the purpose of securing a more favorable renewal contract for the Erie than was accorded the New Englan Telephone Company.

Electrical Matters in Chili, S. A.

(From an Occasional Correspondent.)

SANTIAGO.—Spellier's system of time telegraphs is being introduced into Valparaiso. The engineers who have the work in hand attempted to use a "ground," but the earth currents caused the "dials" to run ahead of the regulator (so reported), and a metallic circuit is now being employed.

It is reported that the Thompson-Houston system of arc lighting will soon be exhibited here by those interested in the Edison light. There is a grand field for electric lighting not only here but in Bolivia and Peru, but the question to be solved is: Will it pay?' I think *not*, at the present rate of exchange, price of coal and the political condition these countries are in, and are likely to be for some time to come.

The government has lately introduced the duplex system of telegraphing upon its lines running north from Santiago, and the local editions of the daily papers are trying to tell the people all about it. One of these gentlemen, who has a farm in the south of Chili, lately wrote to the manager of the telephone company in Valparaiso, stating that he would like to have a telephone, that he had a water wheel that would furnish twenty horse-power for it, and if more would be required he could put in another wheel that would furnish as much more.

Speaking of telephones and the telephone business here, one is constantly reminded of those noted Irish cats that fought until nothing was left but their tails. The Vice-President of the West Coast Telephone Company is on his way to Boston, leaving the business of the company in the hands of a lawyer. The late manager, who is "lively, if not lovely," still hopes to take the fort, and is organizing the National Telephone Company, with a *cash* citaad of $300,000. It is reported that all the stock is subscribed for, and orders for the plant will be forwarded to Europe by next steamer. It is also reported that a German company has been formed to introduce the Van Ryselberghe system of telephone-telegraph lines here, for which the government lately granted a concession. The agent of A. M. Rosebergh, of Toronto, Canada, is here also, preparing to introduce a system which is said to accomplish the same results. There must be millions in the telephone, for those who are most "skilled in the art" seem to be the most anxious to engage in the business. My opinion is that what will apply to electric lighting will hold good in regard to telephoning. A local company will, however, have great advantages over a foreign corporation, and in the end will either drive it from the field or "gobble it up."

Underground in Philadelphia.

Notwithstanding the fact that the City Councils of Philadelphia have not yet granted the companies permission to dig up the streets, the Western Union has already imported into that city a large quantity of costly wire from England and other supplies for the underground system which that company proposes to build. The new system will be briefly this:

Beginning near the Chestnut street bridge, a trench will be opened to below the level of the street pipes, and in this conduit pipes, four inches in inside diameter, will be laid. The ends will be cemented water-tight and a stout cable will be daawn through the pipe. The pipes will be of iron and vitrified terra cotta. Of the latter 2,500 feet only will be put down at present, all of it being assigned to the western end of the line. The use of this pipe is an experiment. It is in four-feet lengths, and will be joined with Portland cement. The iron pipe will complete the trunk line, its use being employed because of the frequent disturbances of the earth on Chestnut street along the business portion. The street will be opened and filled a square at a time. The cables will consist of 60 rubber-covered English coppe wires, costing $100 a mile. These wires will be twisted on the ground into three and a half inch cables, and be drawn through the pipes by means of the cable before mentioned. Four parallel lines of pipes, each containing 60 wires, or 240 in all, will be buried in the trench. Besides these there will be other pipes, containing the wires of the Philadelphia Bell Telephone Company, placed in the same trench. It is probable that the telephone company will have six pipes, with 360 wires.

Metallic "Points" in Arc Lamps.

BY T. E. GATEHOUSE, LONDON, ENG.

In THE ELECTRICAL WORLD of August 29, Mr. H. H. Levett draws attention to a curious phenomenon in arc lamps, noticeable when the lower carbon is replaced by a copper substitute. As I am not desirous of encroaching upon your valuable space by a repetition of Mr. Levett's remarks, I will ask permission only to state the following fact:

Some eight or ten years ago, the late Robert Sabine, with whom I was for many years connected, took out provisional protection in this country for some forms of arc lamps, of which one had a rod of iron in place of the lower carbon. When in action the metal, as stated by your correspondent, fused only at the point of arc, a molten globule there forming and so remaining. Owing to mechanical defects in the feeding apparatus, and more particularly to the ghastly color of the light, the lamp so constructed was shortly afterward abandoned.

Incandescent Lamp Formulæ.

The reports of tests of incandescent lamps are now appearing so frequently that the formulæ employed in the determinations are often the subject of inquiry. We therefore give a short list of the more important ones employed, which will enable any one to calculate the desired quantities with ease, when certain quantities are known:

C. = Current in Ampères.
E. = Electromotive Force in Volts.
$W_{C.P.}$ = Watts per Candle-Power.
C.-P. = Candle-Power.
R. = Resistance of Lamp (hot) in ohms.

1 Electrical Horse Power = 746 watts.

Watts per C.-P. (a measure of the efficiency of the lamp) $= \frac{C. \times E.}{C.\text{-}P.}$

Number of candles per Electrical H.-P. $= \frac{746 \text{ Watts.}}{W_{C.P.}}$

Current in Ampères taken by a lamp, $= \frac{C.\text{-}P. \times W_{C.P.}}{E. \text{ of Lamp.}}$

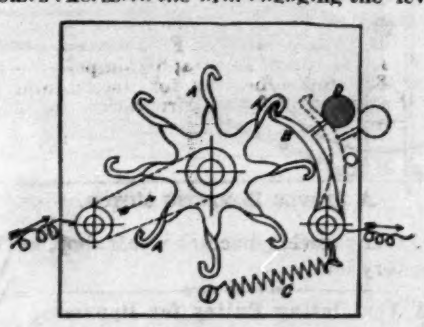
E. M. F. taken by a lamp. $= \frac{C.\text{-}P. \times W_{C.P.}}{C.}$

As the efficiency of conversion of good dynamos may be roundly stated as from 80 to 90 per cent., the calculation of candles per electrical horse-power must be multiplied by the above factor to give the number of candles per *mechanical* horse-power.

A New Safety Cut-Out.

Our illustration shows a safety cut-out recently invented and patented in England, which permits the circuit to be rapidly completed after having been broken.

The diagram shows a star-wheel, with hooked fusible arms *A* engaging with a hooked lever *B*. When the current becomes excessive the arm engaging the lever fuses,



NEW SAFETY CUT-OUT.

and the spring *C* causes the lever to assume the position indicated by dotted lines, the signal disc *D* indicating that the circuit is broken. The lever may then be caused to engage with another arm. The connection may be restored automatically, the star-wheel being caused to rotate by a spring, and a double lever being caused to revolve so as to engage with the fusible arms in succession. Instead of a star-wheel a row of fusible arms fixed in a sliding holder may be used.

REVIEWS OF NEW BOOKS.

INTRODUCTION A L'ETUDE DE L'ELECTRICITE STATIQUE. By M. E. Bichat and M. R. Blondlot. Paris. Gauthier-Villars.

As its name indicates, this work is a treatise on electricity in a state of equilibrim. It occupies a position intermediate between the elementary and more profound study of the science. While mathematics have been freely drawn upon in the exemplification of phenomena, questions of purely mathematical interest have been avoided. The book will be found useful, and is well illustrated throughout.

PROBLEMES DE PHYSIQUE AVEC LEURS SOLUTIONS DEVELOPPÉES. By A. F. Chevallier and Ach. Munts. Second edition. Paris: Gauthier-Villars.

This book is designed to aid students in mastering the problems relating to the more important laws of physics, and gives a series of graded examples which are solved in a simple manner. It includes the principles of gravity, floating bodies and problems in acoustics, optics, heat, etc. The work is admirably suited to prepare students for a course in physics, the examples being carefully selected, so as to bring out the more important facts founded on the principles treated.

A Defective Telegraphic Instrument.

To the Editor of The Electrical World:

SIR: I have a small learner's instrument on a short line from my office to the railroad depot. One of the cores seems permanently magnetized. I have tested it by severing all connections, and still it is magnetized. Is there any remedy for its defects? W. M. MORGAN.

ANSWER.—The remedy is to take out the magnetized core, and insert one of good, soft iron.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Oct. 1, 1885.

The headquarters of Mr. C. J. Sheehan, Assistant Superintendent of the Baltimore & Ohio Telegraph Company, have been transferred from Providence, R. I., to this city. Mr. Sheehan has been appointed the general manager of the Boston District Messenger Service, by President Bates. The business of this service is in a flourishing condition, having 2,500 boxes now in circuit.

The Tarbox Time Register Company, No. 20 North street, has made a great improvement in its watch clocks, consisting in the simplification of the mechanism of the revolving barrel, which adds to its accuracy and durability, and makes it an impossibity for any one to tamper with the working of the clock without being detected.

For the information of those who take an interest in foreign publications treating upon electrical matters, it may be said that a profusely illustrated and magnificently bound electrical book, printed in German, can be found in Bates Hall, in the Public Library. The title of the work is the Elektrische Beleuchtung.

The Edison Company for isolated lighting is now installing a 250-light plant in the factory of the Bates Manufacturing Company, Lewiston, Me.

The Riley Railway Construction Company, of New York, has just organized a sub-company in New England, with headquarters at Room No. 5, No. 54 Devonshire street.

Another Armington & Sims engine has just been put in for the electric light plant at Brookline, Mass., and the number of lights is to be incressed. It is also reported that at an early day incandescent lighting will be furnished for this plant off an arc circuit.

At the laboratory of Messrs. Wilson & Gardner, No. 139 Columbus avenue, they are perfecting a system of portable incandescent lighting by primary battery which is claimed to be specially adapted for general domestic lighting, such as portable hand lamps and hand lanterns, also as library or stand lamps. It may be successfully used, it is said, for mining purposes and in side lights for vehicles, while it fills at the same time a long-felt want among bicycle and tricycle riders. The system is entirely different from the Trouvé, being, it is claimed, more simple, durable and economical.

At the Grinnell cotton mill, New Bedford, Mass., the other afternoon, while an electric light plant was being installed, one of the steam pipes burst, badly scalding Mr. F. B. Comings, of Dorchester, and the superintendent and engineer of the mill. It is feared that Mr. Comings is fatally injured. He was removed to St. Luke's Hospital.

The Callao and Lima papers, under date of July and August, advise us that the subject of electric lighting is receiving marked attention in all the larger cities of Peru. The initial plant, which is being installed at Lima, the capital city, is attracting a great deal of attention, and capitalists in the cities of Callao, Arequipa, Puno, Cuzco, Truxillo, Cajumarca and Puira are earnestly agitating the subject of introducing the electric light in their respective cities. Recent reports from the republic indicate that the outlook for business is exceedingly encouraging, and the promoters of the Peruvian Electrical Construction and Supply Co., which may be said to be entirely a New England enterprise, have every reason to be encouraged with the present prospects of business.

At Milford, Mass., the manufacturers are waking up to the importance of the electric light system, and have nearly completed a plant for the supply of both arc and incandescent lighting. Messrs. Shipper, Field, Eastman and other leading citizens of Milford are the promoters of the enterprise.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Sept. 29, 1885.

The question of electric railways is a very interesting one in the West just now. The success of the Daft motor in New York and other places, and of the Van Depoele motor at Toronto, has brought the matter prominently forward again, and some of the motor people are making efforts which will probably soon result in working an electric road several miles in length. One project which contemplates a road ten miles long, is not yet quite ready for announcement, and there are others which promise to materialize in the near future. The Van Depoele Company have contracted to equip the South Bend, Ind., street railway company's system with their electric motors. A portion of the apparatus will be put on at once, and the first electric train started within a short time. At Toronto, the Exhibition Company will put in a larger Van Depoele plant, so as to run more cars. During the recent exhibition, the Van Depoele road carried over eight thousand passengers a day for six successive days without a hitch, the train making round trips over the mile of track in an average of ten minutes. The Van Depoele exhibition motor in Chicago attracts a good deal of attention when running, and there is another short section of track in the city used to exhibit still another motor. I hope to send you some further particulars regarding electric railways soon.

A 40-light arc electric light plant of the Van Depoele system has just been started at the corner of West Twelfth street and Blue Island avenue.

The Jenney Electric Company, of Indianapolis, have a gang of men at work setting poles and getting ready to string wires preparatory to lighting West Indianapolis, per contract mentioned heretofore.

The Badger Illuminating Company, of Milwaukee, which has been trying for more than six months to get from the Milwaukee City Council an ordinance allowing it to do business in that city under fairly favorable circumstances has at last been successful. The ordinance, as passed, is a carefully considered one, and at the same time satisfactory to the company.

There are some features of this ordinance which are worthy of notice. The first section grants the franchises, and the company is prohibited from assigning it without consent of the council. In the second section the city is divided into two districts, the underground and overhead. The wires in the overhead district are required to be at least forty feet from the ground, and as high as the cornice on the nearest building; the circuits are to be metallic; and the city may put the wires on the company's poles. The third section requires pavements to be replaced when dis-

turbed by the company and prohibits the disturbance of the gas, water or sewer pipes. The fourth section relates that the ordinance grants no exclusive privileges, and requires the company to put up at least twenty miles of wire the first year or forfeit the franchise. The fifth section provides for a bond of $50,000 before the ordinance takes effect. Section six prescribes a maximum price for city lights, which amounts to about two-thirds the price now paid for lighting the same territory. Section seven requires charges to be uniform in all parts of the city. In section eight the council reserves the right to repeal, alter or amend the ordinance at any time, and if this is done because they consider the apparatus dangerous, no compensation is to be allowed the company.

Take it all in all, this must be considered a much better ordinance for both the city and company than is ordinarily evolved by the average city council. The rights of the city are amply protected, and at the same time the company is dealt with quite liberally. It will be seen that the ordinance does not go to extremes as regards underground wires, but provides for placing both the wires overhead and underground, according to circumstances.

The second section, which provides for both overhead and underground wires, met with determined opposition, and the president of the council obtained a good deal of information from other cities on the overhead question while the matter was undecided. This information was obtained from the mayors of no less than twenty cities, and in answer to the following questions:

First—How many miles of electric light wire have you in use in your city?

Second—How many electric lights in use?

Third—What are your views as to the danger of such wires on poles?

Fourth—Has your city experienced any damage of any kind from the use of such wires?

There is a striking similarity between the answers to the third and fourth questions, the replies all being to the effect that, where the wires are properly put up and attended to, there is no danger whatever from them. Milwaukee was six months in granting this franchise, and took plenty of time to look into the matter of overhead and underground wires, and it is probable that she has reached the only sensible conclusion in the premises—a part pole and a part underground ordinance.

The Badger Company are already at work on their plant, and will start in with 300 arc lights. They will do a rushing business. The Westinghouse engine and the Callender wire will be used.

Reference was made two weeks ago to the fact that the district south of Twelfth street, Chicago, had been placed in the same position relative to the electric light companies as had the other portions of the South Side. The work preparatory to lighting this additional district has already commenced. A three-story station, 100×130 feet, will be erected near Twelfth street. This building will accommodate both the Badger Illuminating Company of Chicago, operating south of Twelfth street, and the Badger Electric Company, operating north of Twelfth street. A 300-light plant will be put in to operate south of Twelfth street, and the Badger Electric Company's present plant north of Twelfth street will be operated from the same station. This will make, when finished, one of the largest stations in the West, but large stations seem to be getting quite numerous nowadays.

Mr. J. M. Hirsch, who will be best remembered perhaps by the readers of THE ELECTRICAL WORLD by the monster dynamo for 500 arc lights which he built, or at least projected, is now building dynamos of a more rational size, and is at present engaged in setting up a 40-light machine at Petoskey, Mich., and another one at Traverse City, same State.

The Louisiana Electric Light and Power Company have, within the last 15 days, placed the following order for apparatus:

With the Fort Wayne Jenney Company an order for dynamos, lamps, etc., for 600 arc lights.

With the Bass Foundry and Machine Works, of Fort Wayne, Ind., an order for fifteen high-speed Bass engines, of 50 horse-power each, with boilers, etc., complete, the boilers to be set with the Jarvis furnace.

With the Star Iron Tower Company, of Fort Wayne, an order for 528 O'Beirne mast arms.

All of the above apparatus is to be in position by December 15 next.

On September 15 the City Council of Fargo, D. T., ordered two towers, each to be 125 feet high, of the Star Iron Tower Company, of Fort Wayne.

The incorporation of Fort Wayne-Jenney Companies at Peoria, Ill., and Pekin, Ill., has been mentioned in this column heretofore. Also the facts regarding their contracts with the two cities.

The Peoria Company has now placed the following orders:

With Fort Wayne-Jenney Electric Light Company order for dynamos and lamps for 200 arc lights; with Bass Foundry and Machine Works Fort Wayne, Ind., order for six high-speed Bass engines of 50 h. p. each; Star Iron Tower Company, order for 12 towers, each to be 125 feet high, and 50 mast arms. All the above mentioned apparatus to be in position October 20.

The Pekin Company will use the Fort Wayne-Jenney system of electric lighting, and three of the Star Iron Tower Company's towers. The Star Company has also received an order from the Colorado Electric Company for one tower.

Mr. E. J. O'Beirne has resigned his position as General Manager of the Star Iron Tower Company, and will assume the management of the Louisiana Electric Light and Power Company, of New Orleans. This latter named company controls the State of Louisiana for the Fort Wayne-Jenney system, and now has in its plant at New Orleans 800 Excelsior and 300 Jenney lights; the 600 additional Jenney lights ordered of the Fort Wayne company will give the New Orleans plant a capacity of 1,700 arc lights, making it the largest arc light plant in the United States, we believe.

The Sun Electric Lighting Company has been organized, with headquarters at Chicago.

A wine merchant on Monroe street rented a telephone of the Chicago Telephone Company, which he claimed he could not operate to any advantage. He therefore had the instrument removed, and refused to pay for its use. The telephone company brought suit against him in Justice's Court to recover $60, and got judgment for the amount. The case was then appealed to the Circuit Court, which has just reversed the verdict obtained in the lower court, the jury deciding against the company's claim.

Western telephone stocks, according to Col. S. G. Lynch, stock broker, 144 La Salle street, Chicago, stand as follows:

Central Union	52 @ 53
Michigan	67 @ 69
Great Southern	30 @ 40
Rocky Mountain Bell	50 @ 55
Missouri & Kansas	55 @ 57
Iowa Union	20 @ 23
United	14 @ 15
Chicago	375 @ 400

A civil suit has been brought in the Superior Court, at Indianapolis, wherein the plaintiff states he made application to the Central Union Telephone Company for a telephone to be used in his office, at the same time tendering the legal rate ($3 per month), for the use of the necessary instruments. The company refused to furnish the instruments unless he would bind himself to pay their rate, which, it is claimed, is in excess of that allowed by law. This complaint is filed in the interest of the Citizens' Committee, appointed to look after subscribers' interests in the suit to determine the legality of the law passed by the last Indiana Legislature. The most prominent legal lights of Indiana and adjoining States have been retained by the parties to the suit. The points involved are: 1st. It is unlawful to charge over $3 per month. 2d. It is unlawful to charge more than 15 cents for five minutes' conversation between two towns; also, the company must treat all patrons alike. The court was notified that all technicalities would be ignored, and trial had upon the merits of the case, both parties wishing to push the proceedings to a final decision. The telephone company filed their answer on the 18th, in which they set forth that from time to time new inventions had been added to their equipments, all these improvements having been added at a large expenditure and with increased convenience of the public. Their charges per year have been as follows: Ten dollars for each transmitter, $10 for each hand telephone and $40 for other facilities. Defendants claim that before the demand of the relator they offered to furnish a hand telephone and cords, one magnetic bell and blackboard to be connected with the Exchange and to be served from 7 A. M. to 6 P. M., at $3 per month. The more elaborate equipments are furnished at $5. Defendants state that a royalty of $7 is paid by them to the American Bell Telephone Company for the use of each instrument, and that for the privileges under the contract $500,000 was paid. The company denies the constitutionality of the new telephone law and declares that a $3 rental will not justify the present outlay on its part. The proceedings are watched with interest by telephone subscribers and the general public. The company are not collecting rents for the use of toll lines, having decided to let the charges stand until a decision is reached in the courts.

THE TELEGRAPH.

Ten Minutes for Prayers.—At Concord, N. H., on Sept. 24, the State Board of Equalization gave a hearing to the Western Union Telegraph Company on its assessment for 1884, and a hearing for determining the valuation of the property of the corporation for taxation the present year.

The Hardships of Telegraphers.—Female telegraph operators in Germany receive $240 a year, and no vacation. When one remembers the length of the words they manufacture in the Vaterland, one can have some idea of the hardships under which the female telegraph operator suffers in King William's domain.—*Texas Rail and Wire.*

Fancy Figuring.—Apropos of the decline in Western Union, it may be noted that Western Union's estimate for this quarter a year ago was $204,471 in excess of its actual receipts. The quarterly statement upon which the Western Union dividend has just been declared "estimates" a surplus for the quarter after the dividend of $106,396. If the estimate is as far out this year as last, the company is not earning its dividends.

He Disinfected the Telegram.—The Milan journal *Pungolo*, relates that a Turin marchant, who has correspondence in the French department of Bouches du Rhone, received at his private house at Pinerolo a telegram from Marseilles. Upon reading it he discovered to his great annoyance that it must have been sent off some twenty-four hours before it was delivered to him. He called upon the telegraph clerk to account for the delay, and the honest man at once confessed that the dispatch had indeed lain for a day and a night in his office. He went on to explain that, as it had come from a place where cholera is known to be raging, he had felt himself bound, in compliance with the regulations of the Italian sanitary authorities, to disinfect it by exposing it to the fumes of burning sulphur.

Iron Poles.—A metallic telegraph pole has been adopted, it is said, by the Canadian Government for its telegraph lines on the Northwestern prairies. The pole is constructed of malleable galvanized iron, and is 1¼ inches in diameter at the top and 2½ inches in diameter at the bottom, and weighs less than fifty pounds. The bottom of the pole is set into a claw-plate, upon which the earth is closely packed to a height of about two feet. Then another plate is put into place around the pole, and the earth packed upon it to the level of the ground. The claw-plates take a hold in the ground at once, so that the pole becomes solidly fixed immediately after being set, which desideratum is only obtained by the ordinary wooden pole after it has been in the ground for at least a year. A recent test is said to have shown the great strength of the pole, as a heavy No. 6 Government wire was strung and the poles subjected to the greatest possible strain, but without moving them in the least.

Telegraph and Telephone.—In Philadelphia last week, an application was filed before Judge Thayer on behalf of the Baltimore & Ohio Telegraph Company for a mandamus against the American Bell Telephone Company and the Bell Telephone Company of Philadelphia, requiring the latter corporation to show cause why it should not put a telephone instrument in the main office of the company complainant, at No. 227 Chestnut street. In a petition praying for a mandamus it was averred that the telephone company undertook for an annual rental to furnish to the public, without distinction of class or occupation, telephone instruments connected by wire with a general exchange; that to facilitate its business and to secure greater conveniences to its customers in sending telegrams, the telegraph company had applied for an instrument in its main office, but that the telephone company refused to furnish an instrument "to be used for the purpose of receiving any messages to be sent by telegraph, or delivering any message so received." Such service, it is averred, is only in the ordinary line of the petitioner's business, and as the defendant company has a telephone in the office of the Western Union Company, advertising that fact in its publications and inviting its subscribers to make use of the same for sending telegrams, it is urged that the present refusal is an unjust and unreasonable discrimination. Judge Thayer granted a writ of alternative mandamus, returnable October 3.

THE TELEPHONE.

Output of Instruments.—The output of telephones by the Bell Company during the month ended Sept. 20, was 2,386, and the number returned 2,217, making a net increase of 169, against a net increase of 1,374 for the same month last year.

E. S. Stokes Stirring.—A dispatch of Sept. 24 from Willimantic, Conn., says: It is evident that Edward S. Stokes, who recently bought out the two suits of the McDonough Telephone Company, is pushing the suits vigorously. An order was issued yesterday by the Bell company to take its instruments from all offices of the United Lines as a measure of retaliation. The telephones were removed last evening from the offices of the United Lines at Willimantic, Norwich, New London, and all offices in this vicinity.

The Widow of Mr. Gower.—From Boston the news comes that Lillian Norton, the well-known singer, was married about sixteen months ago to Mr. Frederick A. Gower, who lost his life recently ballooning in Europe. A few months ago she petitioned the court for a divorce from her husband on the ground of abuse. Able counsel was engaged by both parties. A few days before the trial Gower's counsel secured a postponement of the trial so that he could go to Paris. Soon after his arrival in that city Gower accepted an invitation of a friend to make a balloon ascension, and since then nothing has been heard of the balloon or Gower. Mrs Gower has gone to Paris to claim his estate, which is valued at $3,000,000.

THE ELECTRIC LIGHT.

Failure of an English Electric Light Firm.—It was announced by cable from London, on the 28th ult., that Messrs. Oppermann, carrying on an electric lighting business in London and Chicago, have gone into bankruptcy.

New Brush Plants.—The Lake Erie Iron Company, of Cleveland, Ohio, have just put in a 15-light Brush arc plant, which is giving thorough satisfaction, the lights being steady, and requiring less than one-half horse-power each. A Brush lighting station has just been established at Lima, Ohio, and is in full operation. The local papers state that the lights burn without a flicker. It is the intention there to use both arc and incandescent lights on the same circuits. A contract has just been entered into between the City of Carleton, New Brunswick, and Messrs. Clark & Sons, of that city, for Brush electric lights for street illumination. A portion of that city, known as Portland, already has a large number of Brush electric lights.

Electric Light in Philadelphia.—There are now about three thousand electric lights in the city of Philadelphia, public and private, the larger portion of them being owned by four companies, the Brush, the United States, Thomson-Houston and the Excelsior. There are a half-dozen other companies, whose plants are of minor importance. The first electric light in Philadelphia was put up in December, 1881, by the Brush Company, and since that time they have steadily increased in number. The large companies double their list of patrons every year and expect to increase their business in this ratio for some time to come. The nominal light for commercial purposes is of two thousand candle-power. A light of this degree of brilliancy costs fifty-five cents for twelve hours. A collection of gas jets of the same candle power burning the same length of time would cost twelve dollars and the radius of illumination would be much less. Philadelphia gets its public electric lights much cheaper than any other city in the country. The average cost is fifty-five cents per light per night. New York pays seventy cents, Baltimore seventy cents and Boston sixty-five cents, the city furnishing the posts.

MISCELLANEOUS NOTES.

The Resistance of the Roberts Permanganate Battery.—Our readers will no doubt have remarked the apparent high resistance of this battery, described in our last issue. This, however, is an error, brought about by the compositor's omitting to insert a period before the figure 7. The resistance of the cell is not 7 ohms, but .7 ohm.

Southern Activities.—The rolling mills at Birmingham are running full time to fill large orders from all points. The force of men at present is about 500, and will be increased to 800 when the plate-mill is finished. The Sloss and four other furnaces are running to their fullest capacity. Birmingham is a very lively town and is growing at a rapid rate. New industries are constantly being added, and one feels there as though he were in Pittsburgh about twenty years ago, when iron and steel were in their infancy.

Not Modeled by Yankees.—Ships often "come down in the world," instead of sinking in the sea. The Czar Alexander II.'s famous yacht, the Livadia, turned up not long ago as a coal hulk in the harbor of Sebastopol. This is an ignominious ending for a craft which was expected to revolutionize marine architecture. Her hull was hidden in a projecting basement which supported a row of pillars; the had four tiers of decks paved with black, white and ced marble; there was a magnificent marble fountain; she baths were hewn from white marble blocks; rows of electric lights illuminated the saloons and avenue-like rorridors, and the many sets of apartments were finished in rare woods and stones. But the Livadia was not a safe sailer, and she was practically discarded as worthless.

The Self-Induction of a Coil.—In order to determine the self-induction of a coil, the following method may with advantage be employed: Divide the current from a constant battery between a galvanometer circuit, in which

is a coil, and a shunt circuit. At a given moment of time interrupt the shunt circuit and then the galvanometer circuit. Now, if P be the self-induction of the coil, it can readily be calculated from the throw of the galvanometer needle, the exact interval of time between the two interruptions having, of course, been correctly ascertained.—*London Electrician.*

Another Electrical Exhibition.—The project for a new electrical exhibition in Paris has been announced. It is to be held next spring, and will be organized by the International Society of Electricians. Probably it will be a second edition of the exhibition held at the Observatoire a few months ago, with all the modifications and extensions that may be dictated by experience. It is intended to obtain a more central and convenient locality, and to make a special feature of electrical experiments and demonstrations, which will certainly insure for the undertaking a large measure of popularity.

Who Can the Guilty Person Be?—In a London police court recently an elderly man, describing himself as an engineer, without a home, was charged with being a lunatic at large, and not under proper control. An officer said he found the defendant conducting himself in a peculiar way in North-end on the previous night. The defendant: "May I speak a word?" The Mayor: "Yes; certainly." The defendant: "I will tell you what has upset me. It is this American coming over here and charging the earth so heavily with electricity that has caused me to go giddy in my head." The Mayor sent him to the infirmary.

Measurement of Distant Temperatures.—At the Academy of Sciences, St. Petersburg, recently, Dr. Lent described a new and accurate method of measuring distant temperatures. This, it would appear, is based upon the known fact that a thermo-electric current is produced in an arrangement of two wires of dissimilar metals, such as iron and silver, soldered at their two extremities, when one of the junctions is at a different temperature to the other. A galvanometer is put into circuit, and the union at one station is gradually heated until the deflection shown by the galvanometer disappears. When this is the case the two temperatures would presumably be equal.

Deprez's Proportional Galvanometer.—According to the *Centralblatt für Elektrotechnik*, this galvanometer consists of five permanent steel magnets of horseshoe shape placed horizontally one above the other, a pole-piece being fitted on each leg of this compound magnet. The two pole-pieces are hollowed out to a true cylinder, inside which is suspended an iron tube having a coil of wire wound on it, lengthwise. The iron cylinder, being close to the pole-pieces, the magdetic field is both powerful and uniform. The iron cylinder and its coil of wire are supported by two stretched wires, one above and the other below, which serve at the same time to make connection to the coil. A pointer and scale complete the instrument, which gives reliable readings up to 120°.

An Umbrella as a Magnet.—Captain Campbell, master of the steamer Beatrice, running between Larne and Stanraer, has related at Belfast a curious incident which occurred on board during a voyage. It appeared the man at the wheel noticed that the compass was so disturbed by something that he could not keep the vessel on her course. He reported the matter to the officers. The captain, on making an investigation, went to a gentleman leaning against the wooden partition on the starboard side, and asked him if he had a magnet about him. He said no, but he held an umbrella in his hand, which he subsequently handed to the mate. The umbrella was then held toward the compass, and at once the needle was attracted by it. When the umbrella was changed to the opposite side the compass followed it, this proving it to be a very powerful magnet.—*Glasgow Herald.*

Atmospheric Electricity.—The commonly-accepted opinion that during fine weather the air potential is always positive is not accurate for Madras. There it is found that with a dry land wind (*i. e.*, westerly wind) the potential of the air is usually negative during several hours of the day. In the early morning and up to about 9 A. M. the potential is usually positive, then it becomes negative, reaching a maximum between 10 and 11 A. M., and continues negative till the sea breeze sets in in the afternoon. During the prevalance of land winds there are frequent local showers, but these are evidently not the cause of the negative readings. Negative readings are never obtained in fine weather, except when the wind is westerly, and not even then unless the ground is dry. A shower of rain, which cools the ground, makes the succeeding readings positive for some hours. A marked feature during the prevalence of land winds are the great clouds of dust which fill the air, and it seems probable that there is some connection between these dust clouds and the negative electrification of the air.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., b 19, a 24; Am. Cable, b 62½, a 63½; B. & M., b 1, a 1½; Western Union, b 68¾, a 69.

Telephone.—Am. Bell, b 184, a 185; Erie, b 27½, a 27¼.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales, 16 Maiden Lane, New York.

Hale's Honey,

The great cough, throat and lung cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals—beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED SEPTEMBER 15, 1885.

Bulb Case for Incandescent Lamps; S. Howard Sprague, Pittsburg, Pa..... 326,459

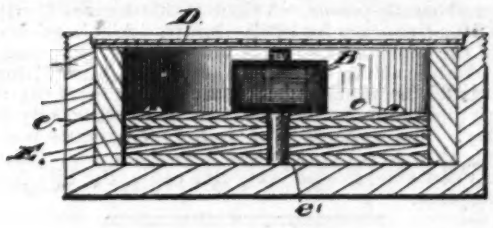
Consists in a translucent casing formed of separate sections, ornamented in any desired pattern, and adapted to inclose removably the bulb of an incandescent electric lamp.

Arch for Supporting Electric Lamps; P. Henry Griffin, Detroit, Mich..... 326,498

It is composed of a series of straight pipes, a suitable base for the same, hollow couplings joining said pipes and provided with pulleys, and a central casting carrying electric contact-points and also provided with pulleys, in combination with cables passing over said pulleys, and mechanism with the said base for operating such cables for elevating and lowering the lamp.

Electrical Conductor for Railways; John Perry and William E. Ayrton, both of County of Middlesex, England..... 326,237

Consists of (*a*) a main insulated conductor or electric main conveying the propelling-current; (*b*) a number of comparatively short service-conductors fairly well insulated from one another and from the earth: (*c*) metallic brushes or equivalent connections coupling a motor on the rain with the service-conductors; (*d*) contact-makers connecting the main conductor with the section of the service-conductor in the vicinity of the train and disconnecting the same when the train has passed.



326,675.—MAGNETO TELEPHONE.

PATENTS DATED SEPTEMBER 22, 1885.

Dynamo Electric Machine; Richard H. Mather, Windsor, Conn..... 326,575

The field-magnet consists of a magnetic core wound as a differential electro-magnet with two coils, which have a constant length or resistance and constantly-closed circuit connections, one of said coils being placed in the main or working circuit of such generator, and the other of said coils being placed in a derived circuit about the work.

Incandescent Lamp; Charles G. Perkins, New York, N. Y., Assignor to the Imperial Electric Light Company, of same place..... 326,584

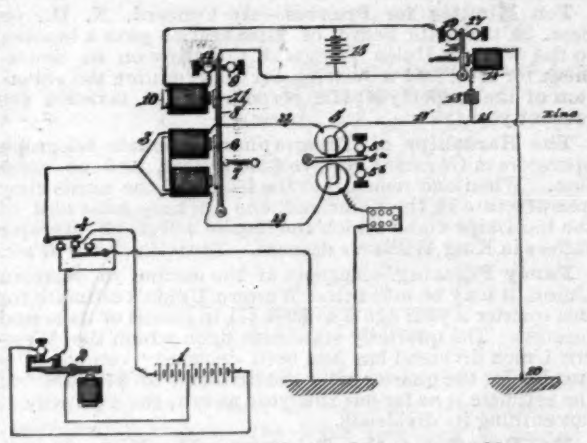
Each lamp contains four filaments, two of which are at right angles to the other two.

Switch; Levi W. Stockwell, Cleveland, O., Assignor to the Cleveland Electric Motor Company, of same place..... 326,603

Consists of a main line, a resistance, an electro-motor, devices for varying the resistance of the branches of the circuit, and a resistance which is connected up in sections, the resistance of each of said sections and of a supplemental resistance being equal to that of the motor.

Telephone Switch; Charles Whitlock and Allen C. Knapp, Chicago, Ill..... 326,610

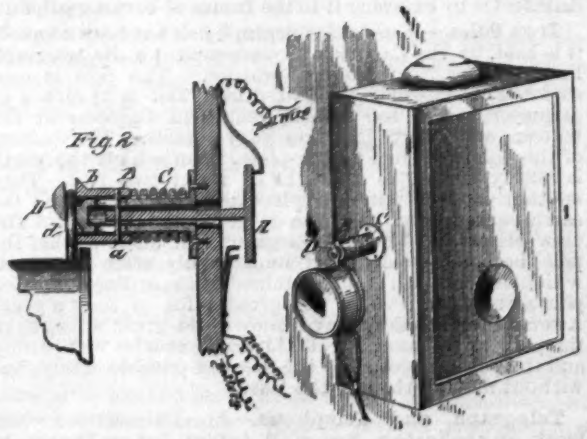
As shown, the fixed jaw is hollow and provided with elongated slots, in which works a pin, *a*, which rigidly connects a sleeve *b* and stem *c*, constituting a sliding jaw. In this construction the spring *C* is confined between the rigid base of the rigid jaw and the inner end of the sleeve portion of the sliding jaw, so that when the telephone is removed the sliding jaw will move outwardly until its face is in contact with the rigid jaw and the switch-plate in contact with the receiver and battery wires, as shown in Fig. 3. If in this position the telephone screw-eye *d* be forced between the jaws, the sliding jaw will be pushed away from the rigid jaw and the switch plate from the terminals of the battery and receiving wires to contact with the bell-wire.



326,982.—PREVENTION OF FALSE SIGNALS IN MULTIPLEX TELEGRAPHY.

Repeater for Quadruplex Telegraphs; George W. Gardanier, New York, N. Y., Assignor to the Baltimore & Ohio Telegraph Co., Baltimore, Md..... 326,637

Consists in applying to one of the instruments of a quadruplex system a circuit-controlling device, whereby an electric circuit may be opened and closed by the operation of that instrument.



326,610.—TELEPHONE SWITCH.

Magneto Telephone; James H. Rogers and J. Webb Rogers, Washington, D. C..... 326,675

The magnets *E* are illustrated as constructed of discs of metal confined or secured by the screws *e* passing through the same. These plates or discs *E* are constructed of a suitable thickness and then magnetized separately. In magnetizing the said discs, they are subjected to the same process as the magnetization of any other form of permanent magnet, either by the use of a dynamo-machine or by a battery-current direct.

Dynamo Electric Machine; William B. Smit and Adriaan Pot, Slikerveer, Netherlands..... 326,796

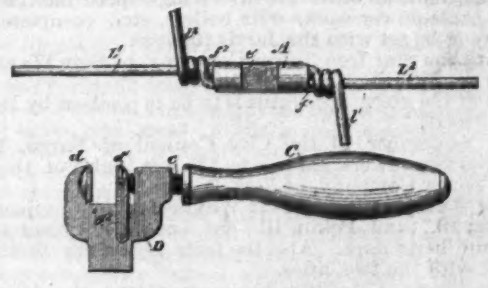
It has a ring armature, the core of which is formed of iron wire wound upon itself into a flat ring, the said iron wire being wound upon and resting in grooves, formed in a series of spokes, to which the wire, when wound, is secured.

Telegraphy; William Maver, Jr., Jersey City, N. J..... 326,880

Two batteries have their opposite poles respectively connected with suitable pole-changing keys. These are employed for transmitting either positive or negative currents to the main lines of the respective systems. Each system is provided with a transmitting key or keys adapted to substitute for the connection of the corresponding main line a connection with a point intermediate between the poles of that battery, that is to say, with a point of lower potential.

Regulator for Dynamos; James J. Wood, Brooklyn, Assignor to the Fuller Electrical Company, New York, N. Y..... 326,894

Consists of the combination, with adjustable commutator-brushes, mechanism for shifting the same, and a power-driven device adapted to be clutched to said mechanism in either direction, to revolve the brushes forward or backward, of a magnet arranged in the working-circuit and controlling the clutching of the power device to the shifting mechanism, with another magnet also arranged in the working-circuit, a shunt in the working-circuit around the first magnet, and a relaxing-contact in said shunt controlled by the second magnet.



326,906.—WIRE-SPLICER.

Wire-Splicer; John A. Helvin, New York..... 326,906

Consists in constructing a short sleeve or thimble of strong metal having two longitudinal perforations of suitable size for receiving the two conductors. Through these perforations it is designed that the ends of the conductors to be united shall be inserted in opposite directions. The protruding end of each conductor is wrapped by hand about the portion of the other conductor adjacent to the thimble or sleeve.

For the purpose of conveniently holding the sleeve so that the wires may not be twisted while the joint is being made, a wrench or holding-clamp of peculiar construction is employed. The thimble or sleeve is formed with two recesses upon opposite sides for receiving the jaws of the clamp. The construction is shown in the cut.

Prevention of False Signals in Multiplex Telegraphy; François Van Rysselberghe, Schaerbeek, Belgium..... 326,982

He combines with the ordinary neutral relay 3 an additional electro-magnet 10, which acts upon an additional armature 11, fixed on the lever 8, bearing the armature 6 of the neutral relay. With said additional magnet 10 is combined any electrical contrivance or devices capable of sending through the circuit of said magnet an instantaneous current at the very moment of the reversal of the current in the main line, if at the same time the lever of the neutral relay is in contact with the stop 12.